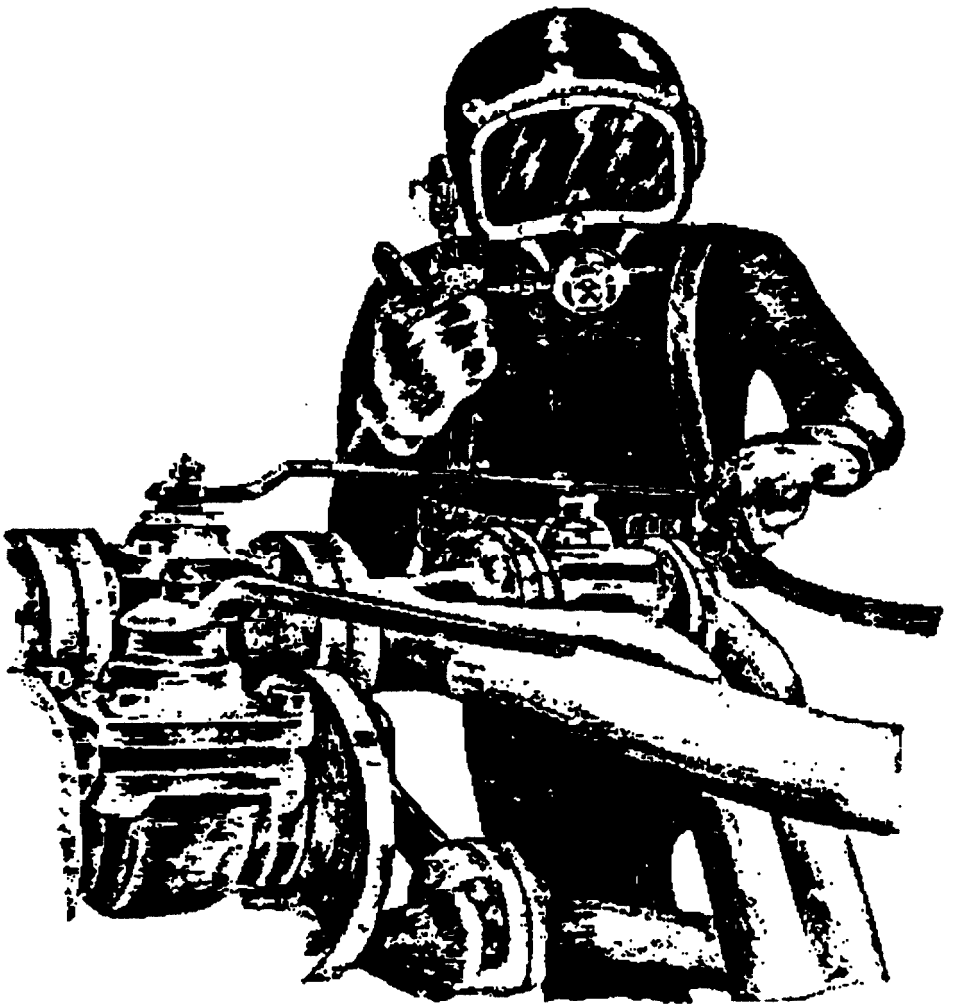
ASSOCIATION OF DIVING CONTRACTORS, INC.



CONSENSUS STANDARDS FOR COMMERCIAL DIVING OPERATIONS

Fourth Edition, 1992
Change 1, 1994

FOREWORD

The members of the Association of Diving Contractors have prepared these consensus standards for commercial diving operations which are performed within the United States of America and its Possessions.

This edition, effective December 1992, and revised in May, 1994, establishes an agreed consensus of ADC members, incorporates governmental regulatory standards, and is subject to periodic review and updates in a concerted effort to further the safety and well being of commercial diving operations.

Diving technology is a rapidly expanding science, and the variations in techniques and task complexity experienced throughout the industry are vast. It has taken several years to assess regional differences in procedures, personnel requirements and equipment considerations in order to determine a basis of safe diving practice. Consequently, this manual is considered to be the minimum acceptable diving safety procedures to be employed in commercial diving operations and may be complemented by additional procedures and requirements as dictated by specific company policies. No set of standard procedures can anticipate all operating conditions which may be encountered and, consequently, no employer nor employee may assume safe operation simply by following these guidelines.

No standard will ever exist which can substitute for common sense, sound judgment, and a continuing concern for maximum safety. Safety is not a rule book; it is a state of mind. As a minimum standard, deviations should always be on the side of increasing safety. However, it is conceivable that an emergency situation could occur which would necessitate immediate action and not allow for full compliance. In such instances a careful plan should be implemented in order to minimize the risks.

All known sources of information have been considered in preparing this guideline. These sources include governmental agencies and regulations, industrial codes and scientific data from university, government and industry.

The Safety, Medical and Education Committee and the Technical Committee of the Association of Diving Contractors will review these standards annually and make changes whenever necessary.

USCG-98-3786-3

*Important * Important * Important*

Consensus Standards Registration Form

Be sure to complete and mail this form to receive **free** revisions/updates of the ADC Consensus Standards and important **SafetyGrams!**

Remember — The official Consensus ***Standards for*** **Commercial Diving** ***Operations*** are avaliable ***only*** through the Association of Diving Contractors.

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Record Of Changes Fourth Edition

This Fourth edition of the ADC Consensus Standards For Commercial Diving Operations supersedes the Third Edition, dated 1991.

Change No.	Date	Description of Change	Page No.
1	May, 1994	Foreword - informing of Change 1, participation of Technical Committee	1 - 2
1	May, 1994	Table of Contents - Replaced to reflect all of Change 1	i - viii
1	May, 1994	Chapter One, Section I, Part B - Preservative Acts	*I - 3*
1	May, 1994	Chapter Two, Section I, Part C, Subpart 6 - Log books	2 - 4, 2 - 5
1	May, 1994	Chapter Two, Section II, Part D - New para. 2 - Log books	2 - 7
1	May, 1994	Chapter Three, Section V, Part C, Subpart 11 - Bailouts	3 - 24
1	May, 1994	Chapter Three, Section V, Part D, Subpart 1, a & b	*3 - 24*
1	May, 1994	Chapter Three, Section V, Part D, Subpart 3 -Equipment	3 - 25, 3 - 26
1	May, 1994	Chapter Three, Section V, Part G, Subpart 5 - Equipment	3 - 31
1	May, 1994	Chapter Three, Section VI - New section, "Diving with ROVs"	3 - 33
1	May, 1994	Pages renumbered to incorporate new section	3 - 34 to 3 - 40
1	May, 1994	Chapter Three, Section IX, Emergency Procedures - Several emergency procedures concerning diving hyperbaric incidents removed from section - replaced by new Therapy Guidelines	n/a
1	May, 1994	New Insertion, Guidelines for *Treatment* of *Decompression Incidents* (This Document is available as a separate booklet from the ADC)	1 tot- 16
1	May, 1994	Chapter Four, Equipment and Systems - Entirely new Chapter rewritten by Technical Committee, replaces old Chapter Four	4 - 1 to 4 - 18
1	May, 1994	Glossary - Expanded, replaces old Glossary	a to h

Special Note

A technical publication is of value only insofar as it is maintained in current, up-to-date condition. The Association of Diving Contractors periodically updates *the Consensus Standards for Commercial Diving Operations* to reflect new developments and procedures in the commercial diving field. These updates are in the form of major revisions, such as this Fourth Edition, effective December 1992, or periodic changes, as recorded on the reverse of this page. All registered owners of the Standards will receive free revisions or changes as they are issued, along with a new "Record of Changes" page.

To ensure that your copy of the Standards remains up-todate, please maintain a current address with the offices of the ADC. A registration card is contained in the manual for this purpose. Many "pass-along" copies of the Standards exist, in various degrees of obsolescence, and the ADC receives many returned mailings. A check with the ADC office will confirm that your version of the Standards is current and your address is correct.

Copies of the *Consensus Standards for Commercial Diving Operations* are available from:

Association of Diving Contractors, Inc.
2611 FM 1960 West, Suite F-204
Houston, TX 77068
Phone (713) 893-8388, Fax (713) 893-5118

All individuals, contractors, clients, members of the ADC, or other bodies concerned with the safety of the commercial diving industry are requested to submit constructive criticism and recommendations for improvement of the Standards to the above address, in care of the Safety, Medical and Education Committee. This committee is responsible for publication, annual review, revisions and incorporation of valid new material from all sources. The ADC Board of Directors is responsible for final approval.

Table of Contents

SPECIFICATION AND OPERATION OF DYNAMICALLY POSITIONED DIVING SUPPORT VESSELS 6 - 1

Chapter One

GENERAL PROVISIONS

Fourth Edition, 1992

I. Scope And Application

A. Purpose

The primary purpose of these consensus standards is to ensure the safety and well being of the commercial diver.

These consensus standards apply to all types of work, whether inshore or offshore, involving diving operations. It is meant for this standard to complement applicable governmental rules and regulations as well as to supplement industrial codes of safe practices for diving operations.

Nothing contained in this manual shall be construed to take the place of any law, rule or regulation of any governmental agency.

B. Preservative Acts

It is espressly provided and declared that in an emergency situation requiring the saving of personnel, any diving company, its officers, directors, agents or employees may act in variance with the operating procedures and recommendations established in this standard.

Chapter Two

PERSONNEL REQUIREMENTS

I. Personnel Qualifications

A. General

Each person engaged in diving operations shall possess the necessary qualifications for his job assignment. Designation of skill levels in these standards incorporates three primary elements:

- Technical Proficiency
- Field Experience
- Diving Proficiency

Persons assigned to specific diving activities shall possess the following:

1. Knowledge and skills gained through training or experience in the following:
   - Diving procedures and techniques
   - Emergency procedures
   - Physiology as it relates to diving
   - Diving equipment
   - First aid and C.P.R.

2. Familiarity with procedures and proficiency in the use of tools, equipment and devices associated with the assigned tasks

3. Forpcrsons engaged as divers, or otherwise exposed to hyperbaric conditions, physical qualifications for such activities as outlined in Section II, "Medical Requirements" (Page 2-6), and detailed in Section III entitled "Medical Standards And Recommendations" (Page 2-9). Such physical qualifications must be documented on an ASSOCIATION OF DIVING CONTRACTORS *Medical History and Physical Examination Form.*

4. For persons who operate decompression chambers, knowledge of chamber operations

A person lacking the required experience and proticicncy outlined above may be assigned limited tasks, under the direction of an cspcricnccd and qualified individual, in order to obtain the experience and level of proficiency required.

B. Entry Level Qualifications

The entry lcvcl. minimum skill designation on the diving crew is a Tender. The beginning tender satisfies the minimum entry qualifications of Diving Proficiency, Technical Proficiency and Experience by successfully completing a formal course of study. This may bc taken at an Association of Commercial Diving Educators (A.C.D.E.) accredited school, Military school, or cquivalcnt. Personnel previously employed without meeting these qualifications must be certified by the employing contractor as having achicvcd an equivalent dcgrcc of training through a combination of field experience and formal classroom instruction.

Tenders may be Non **Diving** or **Diving.** The **Diving** Tender must **also** satisfy the **requirements** of Section A - 3 above.

C. Minimum Required Experience and Proficiency

1. Advancement beyond the **designation** of Tender requires a **minimum amount of** field experience and diving **proficiency. Additional required technical qualifications** are **detailed separately in** Chapter 3, Section II, **Specific Operations Procedures** for the **appropriate** diving mode **under** the heading "Minimum Qualifications of Personnel".

2. **Field Experience** establishes the **minimum** field days of **experience** on a **diving** crew **required** to **obtain various designations.** Field **experience** is **defined** as field days **(offshore,** inland lakes, **harbors** and rivers] **directly participating** as a diver, **supervising** divers, or **surface-tending** divers engaged in **marine operations. Experience** at **higher qualification** levels may be **directly substituted** for time **requirements** in **lower designations** to **achieve** a given **designation.**

3. **Diving Proficiency** establishes the **minimum number** of **open-water** dives **required** to **obtain various designations. All** dives **must** be **performed during** a **24-month** period **immediately** prior to **issuance** of **the designation. Work** must be **performed** during **each** dive **with** proper **supervision.** Ail dives must have a **minimum** of **20 minutes bottom** time. A **number** of shorter **duration** dives may be **combined** to equal one dive of the **required** 20 **minute** bottom time.

4. Advancement to **higher designations** requires **completion** of **training** and **experience** for **all lower designations.**

5. **Minimum Qualifications:**

   - **Diver/Tender**
     Technical proficiency appropriate to the specific diving mode as detailed in the section, **Specific Operations Procedures,** *Minimum Qualifications of Personnel*
     50 Field Days Total
     10 Dives Total
   - **Diver**
     Technical proficiency appropriate to the specific diving mode as detailed in the section, **Specific Operations Procedures**, *Minimum Qualifications of Personnel*
     100 Field Days Total
     30 Dives Total

6. **Diver's Personal Log Books**
   All divers shall **maintain** a **personal** dive log **(ADC Professional** Diver's Log Book *or* **equivalent)** that **will** detail all **hyperbaric exposures.** The Log Book **must** be **identified** with the diver **using** it by **photograph, signature,** and home **address. The following minimum information should** be entered in the Log Book:
   - **Diving Contractor's name** and address
   - Date of the dive
   - **The** name or other **designation** and **location** of the **diving** site or vessel, from where the **diving operation** was carried out
   - **Maximum** depth reached on the dive

- 0 The time left surface, bottom time, and the time reached surface for each hyperbaric exposure
- Surface interval, if dive includes chamber time for decompression
- Type of breathing apparatus and mixture used
- Task performed
- Type and designation of the decompression table and schedule used
- Any DCS or injury incurred during the dive
- Comments section
- Diver's signature
- Supervisor's signature
- Place for a counter-signature or stamp of the diving company

Additional pages must be provided to show:

- Dates of diving physicals, signed by the examining physician
- A record of all relevant training sessions
- A record of all equipment testing and maintenance

The diver shall present his personal logbook to company authorities for verification and stamping at quarterly, but no less than annual intervals.

D. Designated Diving Supervisor

1. A qualified person shah be designated in charge of each diving operation.

2. The responsibilities of such designated person should include job planning, coordination, record keeping and proper response to any job-related emergency, as well as knowledge of the appropriate Govemmental regulatory agency regulation.

II. Medical Requirements

A. General

For persons engaged as divers. or otherwise subjected to hyperbaric conditions, the following ADC medical examinations are required.

1. An initial medical examination exccpf as provided in paragraph B2 below

2. Periodic re-examinations:
   - Recommended annually, minimum every two years
   - Annually after thirty-five years of age

3. A re-examination after a diving-related injury or illness as needed to determine his fitness to return to diving duty.

B. Physical Examination

1. For persons engaged as divers, or otherwise subjected to hyperbaric conditions, the initial examination, and periodic medical re-examinations, include the following:
   - Work History
   - The tests required in Table I (Page 2-8), as appropriate
   - Any tests deemed necessary to establish the presence of any of fhe disqualifying conditions listed in paragraph "E" of this section
   - Any additional tests the physician deems necessary to prepare the written report required by paragraph "D" of this section

2. If, within one year, the person has had a comprehensive medical examination comparable to the initial examination specified by this section, and if the results of this examination did not indicate the presence of significant abnormalities affecting the organs, systems, or general health of the person, or any of the conditions in paragraph "E" of this section, said examination will be deemed to have satisfied the requirements for the initial examination.

C. Re-examination After Injury or Illness

1. Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical examination following a known diving-related injury or illness which requires hospitalization of 72 hours or more, (unless state or local laws dictate otherwise) or known decompression sickness with audio-vestibular or central nervous system dysfunction.

2. The person should not be permitted to return to work as a diver. or otherwise be subjected to hyperbaric conditions until he is released by a physician to do so.

3. The examining physician should determine the scope of the examination in light of the nature of the injury or illness.

D. Physician's Written Report

A written report outlining a person's medical condition and fitness to engage in diving or other hyperbaric activities should be provided by the examining physician any time a physical examination is required herein, The written report should be accompanied with a completed copy of the standard *ADC Physical History/Examination Form* or it's equivalent,

The physician should also endorse the medical section of the diver's personal log book

E. Disqualifying Conditions

A person having any of the following conditions, as determined by a physician's examination, shall be disqualified from engaging in diving or other hyperbaric activities:

- History of seizure disorder other than early childhood febrile convulsions
- Cystic or cavitary disease of the lungs, significant obstructive or restrictive lung disease, or recurrent pneumothorax
- Chronic inability to equalize sinus and middle ear pressure
- Significant central or peripheral nervous system disease or impairment
- Significant cardiac abnormalities
- Chronic alcoholism, drug abuse or history of psychosis
- Significant hemoglobinopathies
- Significant malignancies
- Grossly impaired hearing
- Significant osteonecrosis
- Chronic conditions requiring continuous control by medication
- Pregnancy

F. Withdrawal from Hyperbaric Conditions

It shall be determined on the basis of the physician's examination, whether a person's health will be materially impaired by continued exposure to hyperbaric conditions. The physician should indicate any limitations or restrictions which would apply to the person's work activities in his written report.

G. Medical Recordkeeping

1. An accurate medical record for each person subject to the medical specifications of this section should be established and maintained. The record should include those physical examinations specified herein including *ADC Physical History/Examination Forms* and the physician's written reports,

2. The medical record shah be maintained for a minimum of 5 years from the date of the last hyperbaric exposure unless otherwise prescribed by law.

TABLE 1

MEDICAL TESTS FOR DIVING

Test	Initial	Periodic	Comments
History & Physical	X	X	Include predisposition to unconsciousness vomiting, cardiac arrest, impairment of oxyge transport, serious blood loss, or anything which i the opinion of the examining physician wi interfere with effective underwater work.
Chest X-Ray	X	X	PA (Projection: 14" x 17" minimum)
Bone & Joint X-Ray Survey	X		Required initially and as medically indicated.
EKG: Standard (12 L)	X		Required initially to establish baseline, annuall after age 35, and as medically indicated.
EKG: Stress			Required only as medically indicated.
Pulmonary Function	X		Do
Audiogram	X	X	Threshold audiogram by pure tone audiometry bone conduction audiogram as medicall indicated.
EEG			Required only as medically indicated.
Visual Acuity	X		Required initially and as medically indicated.
Color Blindness	X		Required initially.
Hematocrit, Hemoglobin, White Blood Count	X	X	
Routine Urinalysis	X	X	

III. Medical Standards and Recommendations

A. Introduction

The following recommendations arc set forth by the Association of Diving Contractors Safety, Medical and Education Committee. They are intended to bc used with the ADC *Medical History /Physical Examination Form*. They deal with specific aspects of the subject's physical fitness to dive by item number. These standards are offered in what WC believe to bc. in most cases, the minimum requirements. The use of these standards is intended to be tempered with the goodjudgment of the examining physician, Where the examining physician is in doubt about the medical fitness of the subject, he should seek further opinion/consultation and recommendations of an appropriate specialist in that field. Particular attention must be paid to past medical and diving history. In general. a high standard of physical and mental health is required for diving. Consequently, in addition to excluding major disqualifying medical conditions, examining physicians should identify and give careful consideration to minor, chronic, recurring or temporary mental or physical illnesses which may distract the diver and cause him to ignore factors concerned with his own or others' safety.

The. spectrum of commercial diving includes industrial tasks performed from just below the surface to deep saturation diving. Job descriptions and therefore job limiting disabilities may vary widely. The standards, in general, apply to all divers. Some consideration must be given to the subject's medical history, work history, age. etc.

There is no minimum or maximum age limit, providing all the medical standards can be met. Serious consideration must be given to the need for all divers to have adequate reserves of pulmonary and cardiovascular fitness for use in an emergency. The lack of these reserves may possibly lead to the termination of a professional diving career. The examining physician should exercise the appropriate professional judgment to determine whether, in particular circumstances, additional testing may be warranted. Disqualification for the inability to meet any of these standards must be done on a case by case basis related only to the specific job functions of the position being applied for, and assuming reasonable accommodations can not be made.

Upon application of the ADC company to and concurrence by the esamining physician in particular medical circumstances, a permitted variance may be granted to be in effect until the diver's next periodic diving physical. At this time the permitted variance is to be subject to the examining physician's review and comment. Examining physicians must have a list of the essential job functions (Job Description) to review with each commercial diving physical examination. The examining physician is encouraged to make any recommendations for reasonable accommodations necessary for a person to meet these standards.

The numbered items within these standards refer to boxes on the ADC *Medical History/Physical Examination Form*. These forms arc available from the offices of the ADC and should be used by all examining physicians conducting ADC Diving Physical examinations.

If any further clarification of this recommended standard is dcsircd. please contact the ADC Safety, Medical and Education Committee.

B. ADC Physical Examination Standards

The following headings refer to and explain the numbered boxes on the ADC *Physical Examination Form* on pages 3 and 4. Patient history is recorded on pages 1 and 2 of the form set. A sample copy of these forms is enclosed in this Standard following Section III after page 2-14. Use of these forms ensures quality and consistency throughout the commercial diving industry. They may be obtained from the office of the ADC.

 # 1 Name
Record

 # 2 Social Security Number
Record

 # 3 Height
No set limits.

 # 4 Weight
The weight standards listed below should apply. If a diver exceeds these standards and the cognizant physician feds the increase is due to muscular build and physical fitness, a variance is appropriate. Furthermore, individuals who fall within these weight standards but who present an excess of fatty tissue should be disqualified.

Height in. (cm)	Max. Weight lbs. (kg)	Height in. (cm)	Max. Weight lbs. (kg)
64 (162.56)	164 (73.80)	72 (182.88)	205 (92.25)
65 (165.10)	169 (76.05)	73 (185.42)	211 (94.95)
66 (167.64)	174 (78.30)	74 (187.96)	218 (98.10)
67 (170.18)	179 (80.55)	75 (190.50)	224 (100.80)
68 (172.72)	184 (82.80)	76 (193.04)	230 (103.50)
69 (175.26)	189 (85.05)	77 (195.58)	236 (106.20)
70 (177.80)	194 (87.30)	78 (198.12)	242 (108.90)
71 (180.34)	199 (89.55)		

 # 5 Temperature
The diver should be free of any infection/disease which would cause an abnormal temperature.

 # 6 Blood Pressure
Ideally the resting blood pressure should not exceed 140/90 nun Hg. In eases of apparent hypertension, repeated daily blood pressure determinations should be made before a final decision.

 # 7 Pulse/Rhythm
Persistent tachycardia, marked arrhythmia except of the sinus type or other significant disturbances of the heart or vascular system should be disqualifying.

 # 8 Hygiene
Should be good.

 # 9 Nutrition
Should be good.

 # 10 Build
Record

 # 11 Distant Vision
Should have vision in both eyes, corrected to 20/40, O.U.

 # 12 Near Vision
Uncorrected - J16

 # 13 Color Vision

Record

 # 14 Field of Vision

Should be normal with any discrepancies documented.

 # 15 Contact Lenses

Record if used.

 # 16 Head, Face and Scalp

The causes for rejection may be:

a) Deformities of the skull in the nature of depressions, exostosis, etc. of a degree which would prevent the individual from wearing required equipment.

b) Deformities of the skull of any degree, associated with evidence of disease of the brain, spinal cord or peripheral nerves.

c) Loss or congenital absence of the bony substance of the skull.

 # 17 Neck

The causes for rejection may be:

a) Cervical ribs if symptomatic.

b) Congenital cysts of branchia! cleft origin or those developing from the remnants of the thyroglossal duct, with or without fistulous tracts.

c) Fistula, chronic draining, of any type.

d) Spastic contraction of the muscles of the neck - persistent and chronic.

 # 18 Eyes

Active pathology or previous eye surgery may be cause for restriction or rejection.

 # 19 Fundus

No pathology.

 # 20 thorough # 24 - Ears, Nose, Throat and Eustachian Tube

The following conditions are disqualifying: acute disease, chronic serious otitis or otitis media, perforation of the tympanic membrane, (#23), any significant nasal or pharyngeal respiratory obstruction, chronic sinusitis if not readily controlled, speech impediments due to organic defects, or inability to equalize pressure due to any cause.

 # 25 Mouth

a) Candidates should have a high degree of dental fitness; any abnormalities of dentition or malformation of the mandible likely to impair the diver's ability to securely and easily retain any standard diving equipment mouthpiece should disqualify.

b) Removable dentures should not be worn while diving.

c) Record the date of most recent dental X-rays. Record Dentist's name and address to enable X-ray location if needed for post-mortem identification.

 # 26 Lungs and Chest (include Breasts)

Pulmonary: congenital and acquired defects which may restrict pulmonary function, cause air entrapment or affect the ventilation-perfusion balance sha!! be disqualifying for both initial training and continuation. In genera!, chronic obstructive or restrictive pulmonary disease of any type shall be disqualifying.

 # 27 Heart (Thrust, size, rhythm, sounds)

Cardiovascular system: There should be no evidence of heart disease. Any arrhythmias must be fully investigated.

 # 28 Pulse

Record

 # 29 Vascular System

Cardiovascular system: The cardiovascular system shall be without significant abnormality in a!! respects as determined by physical examination and tests as may be indicated. Persistent tachycardia and arrhythmia except of sinus type, evidence of arteriosclerosis (an opthalmoscopic examination of the retina! vessels shall be included in the examination), severe varicose veins and marked symptomatic hemorrhoids, may be disqualifying.

 # 30 Abdomen and Viscera

a) Peptic ulceration should be a cause for rejection unless healed and the candidate has been asymptomatic for at least 3 months without supportive medication.

b) Any other chronic gastro-intestinal disease (e.g. ulcerative colitis, cholelithiasis) should be cause for rejection.

 # 31 Hernia

Any significant abdominal herniation should be a cause for rejection until satisfactory repair has taken place.

 # 32 Endocrine System

Any endocrine disorder requiring daily or intermittent medications for control is disqualifying. Diabetes mellitus, either insulin, oral hypoglycemic agent or diet controlled is disqualifying.

 # 33 G.U. System (Genital-urinary) system:

a) Venereal disease will disbar until adequately treated.

b) Evidence or history of nephrolithiasis must be fully investigated and treated.

c) Evidence or history of urinary dysfunction or retention must be fully investigated and treated.

 # 34 Upper Extremities (Strength, ROM)

Any impairment of musculoskeletal function should be carefully assessed against the general requirements which would interfere with the individual's performance as a diver.

 # 35 Lower Extremities (Except feet)

Any impairment of musculoskeletal function should be carefully assessed against the genera! requirements which would interfere with the individual's performance as a diver

 # 36 Feet

Any impairment of musculo-skeletal function should be carefully assessed against the general requirements which would interfere with the individual's performance as a diver.

 # 37 Spine

Any impairment of musculo-skeletal function or skeletal structure should be carefully assessed against the general requirements which would interfere with the individual's performance as a diver.

 # 38 Skin-Lymphatics

There should be no active, acute *or* chronic disease of the skin or Lymphatic system.

 # 39 Anus and Rectum

Any conditions which interfere with normal function, e.g. stricture, prolapse, severe hemorrhoids may be disqualifying.

 # 40 Sphincter Tune

Note and record.

 # 41 Pelvic Exam

Must be within not-ma! limit.s. Pregnancy at any stage may be disqualifying. Any menstrual disorder manifested by abnormal or prolonged bleeding, as we!! as excessive pain may be disqualifying.

 # 42 Neurological Exam

Sensorium - A full examination of the central and peripheral nervous system should show normal function, but localized minor abnormalities, such as patches of anesthesia, are allowable provided generalized nervous system disease can be excluded. Any history of seizure (apart from childhood febrile convulsions), intracranial surgery, loss of consciousness, severe head injury involving more than momentary unconsciousness or concussion, should be cause for rejection. If the severity of head injury is in doubt, special consultation and studies should be considered.

 # 43 Cranial Nerves

Examine and record.

 # 44 Reflexes

Should be normal and free from pathology. Document any abnormality.

 # 45 Cerebral Function

Test and record.

 # 46 Power and Tone of Muscles

Examine and record.

 # 47 Proprioception - Stereognosis

Examine and record.

 # 48 Romberg

Do and record.

 # 49 Unterberger

Optional, (if done, record.)

 # 50 Nystagmus

Do and record.

 # 5l Sensations

Test and record.

 # 52 Miscellaneous Remarks and Dermatome Diagram

Record fmdings and comments.

 # 53 Urinalysis

Includes color, PH, specific gr., Glucose, albumin, micro and all results should be within normal limits.

 # 54 Blood Tests

a) Hematology: Any significant anemia or history of hemolytic disease must bc evaluated When due to a variant hemoglobin state, it shall be disqualifying.

b) Serology test done. If positive, cause for rejection until properly treated and cleared.

c) All applicants for diving duty should have a sickle cell and AIDS test done and recorded.

 # 55 Pulmonary Function

Pulmonary function tests:

a) All divers must have periodic pulmonary function tests to establish Forced Expiratory Volume at one (I) second (FEVl) and Forced Vital Capacity (FVC) recording best of three measurements.

b) A FEVl/FVC x l00 ratio of less than 75% requires additional specialized pulmonary function tests to determine suitability.

 # 56 X-rays

a) 14 x 17 Chest - no pathology within normal limits

b) Lumbar Sacral Spine

c) Long Bones - any lesions, especially juxta-articular, should be evaluated to determine patient's fitness to dive.

 # 5 7 Electrocardiogram

ECG examinations: all divers should have a resting standard 12 Lead ECG at initial examination and annually after the age of 35 years.

 # 58 Audiogram Pure Tone

A hearing loss in either ear of 35 dB or more at frequencies up to 3000 Hz and 50dB or more at frequencies above 3000Hz to a minimum of 6000 Hz is an indication for referral of the candidate to a specialist for further opinion, unless the examining doctor is convinced that such hearing loss is unlikely to be significantly increased by continuous diving activities. Doubts about function of labyrinths require specialized examination.

 # 59 SMA-32

Optional, if done record

 # 60 Drug Screen

Do and record.

C. Psychiatric

The special nature of diving duties requires a careful appraisal of the individual's emotional and temperamental fitness. Personality disorders, phychosis, immaturity, instability and asocial traits shall be disqualifying. Severe stammering or stuttering shall disqualify. Any past or present evidence of psychiatric illness shall be cause for rejection unless the examining doctor can be confident that it is of a minor nature and unlikely to recur. Particular attention should be paid to any past or present evidence of alcohol or drug abuse. Any abnormalities should be noted in Block #52 of the physical examination form.

D. Temperament

The special nature of diving duties requires a careful appraisal of the candidate's emotional, temperamental and intellectual fitness. Past or recurrent symptoms of neuropsychiatric disorder or organic disease of the nervous system shall be disqualifying. No individual with a history of any form of epilepsy, or head injury with sequelae, or personality disorder shall be accepted. Neurotic trends, emotional immaturity or instability and asocial traits, if of sufficient degree to militate against satisfactory adjustment, shall be disqualifying. Stammering or other speech impediment which might become manifest under excitement is disqualifying. Intelligence must be at least normal. Any abnormalities should be noted in Block #52 of the physical examination form.

ASSOCIATION OF DIVING CONTRACTORS

Medical History Form

Company's Name _____

Date					
1. Last Name	First Name	Middle Name	2. Date of Birth	SCX	3. SSN
4. Address (Number, Street, City, State, Zip Code)				5. Area Code/Telephone Number	
6. Position	7 Spouse Name		8. CHECK ONE:	( ) Single ( ) Divorced ( ) Married ( ) Widowed	
9. No Children	10. Next of Kin/Relationship/Address/Telephone Number				

11 My Present State of Health is: ( ) Excellent ( ) Good ( ) Fair ( ) Poor

12. MEDICAL HISTORY Have you ever had or been treated for:

Yes	No		Yes	No		Yes	No	
___	___	Skin Rash	___	___	Abnormal Heart Rhythm	___	___	Rheumatism
___	___	Convulsions	___	___	Fainting Spells			Back Strain
___	___	Epilepsy			Heart Trouble			Dislocations
___	___	Head Injury			Asthma			Paralysis
___	___	Disabling Headaches	___	___	Coughing of Blood			Muscle Weakness
___	___	Nervous Breakdown			Tuberculosis	___	___	Knee Injury or "Trick Knee"
___	___	Uncorrectable Vision			Shortness of Breath			Shoulder Injury
___	___	Color Vision Defect			Lung Trouble			Arthritis
		Eye Trouble (not glasses)	___	___	Chronic Cough			Broken Bones
		Eye Surgery	___	___	Gallbladder Trouble			Disc Problems
___	___	Defective Hearing	___	___	Stomach Trouble or Ulcers			Swollen Ankles
		Ear Trouble	___	___	Jaundice			Foot Trouble
___	___	Perforated Eardrum	___	___	Rupture			Elbow Injury
___	___	Hay Fever	___	___	Liver Disease			Diabetes
-	___	Nose Bleed	___	___	Appendicitis			Tumor or Cancer
-	___	Airway Obstruction	___	___	Kidney Tro			Goiter or Thyroid Trouble
___	___	Chest Pain	___	___	Protein [illegible] Sug[illegible]rine			Blood Disease
___	___	Heart Murmur	___	___	Blood [illegible] Urine			Anemia: Sickle Cell or other
___	___	High Blood Pressure	___	___	Rectal [illegible]ding			Irregular Menses
___	___	Rheumatic Fever	___	___	[illegible]morr[illegible] (Piles)			Painful Menstral Cycle
___	___	Varicose Veins	___	___	[illegible]ins			Pregnant
___	___	Heart Attack						

PLEASE EXPLAIN THE DETAILS OF ALL CHECKED YES [illegible]

13 LIST ALL SURGERIES, SERIOUS ILLNESSES OR INJURIES: YEAR

14 ANSWER THE FOLLOWING QUESTIONS: Every Item Checked Yes Must Be Fully Explained In Blank Space

	Yes	No		Yes	No
Do you have any physical defects or any partial disabilities?			Have you been advised to have a surgical operation or medical treatment that has not been done?		
Do you have any condition that may require special work assignment?			Have you ever resigned, been terminated or changed jobs for medical reasons?		
Have you ever been rejected or rated for insurance, employment or armed forces for health reasons?			you excess use of alcohol or drugs?		
Have you had significant exposure to mining dust, asbestos, silica or toxic chemicals?			Do you presently use marijuana, LSD, narcotics or controlled substances?		
Have you ever had ill effects from any work that you have done?			Do you have any allergies or reactions to food, chemicals, drugs, insect stings or marine life?		
Are you taking any type of medications including Patent medicines?			Are you presently under the care of a physician? Give physician's name and address.		

COMMENTS _____

16. MY PERSONAL PHYSICIAN IS:

17. HOW LONG HAVE YOU BEEN DIVING? _____
Max. Depth: Sur. Air _____
Sur. Mixed Gases _____
Longest Bottom Time: Air _____
Mix Gas _____
HAVE YOU MADE ANY SATURATION DIVES? ( )Yes ( ) No
Gas Mix: Heilox □ Trimix □ Nitrox □
Max. Depth _____ Total Duration (Days) _____

18. DIVING EXPERIENCE: (Number of Years Experience)

AIR _____ MIXED GASES _____ SATURATION _____

HAVE YOU PASSED AN OXYGEN TOLERANCE TEST? _____ NAME OF COMPANY/SCHOOL _____

19. NUMBER OF DECOMPRESSION INCIDENTS:

Bends: Pain Only _____ Neurological _____

Serious Symptoms: Chokes _____ Inner Ear _____

List any residuals: _____

20. IN DIVING HAVE YOU HAD A HISTORY OF: (Provide details of dates and severity)

Gas Embolism	_____	Lung Squeeze	_____
Oxygen Toxicity	_____	Near Drowning	_____
CO2 Toxicity	_____	Asphyxiation	_____
CO Toxicity	_____	Vertigo (Dizziness)	_____
Ear Squeeze	_____	Pneumothorax	_____
Ear Drum Rupture	_____	Nitrogen Narcosis	_____
Sinus Squeeze	_____	Loss of Consciousness	_____
Deafness	_____		

21. Have you been involved in a diving accident (decompression sickness or [illegible]) since your last physical examination? _____
Date of last physical examination _____

For what company or organization were you examined _____
Name and address of physician who performed your last examination: _____

22. Have you ever had any of the following? If so, give approximate date.

( ) Chest X-Ray	_____	( ) Nerve Condition Studies	_____
( ) Longbone Series	_____	( ) Pulmonary Function Studies	_____
( ) Back (Spine) X-Ray	_____	( ) Audiogram	_____
( ) ENG	_____	( ) EKG	_____
( ) EEG	_____	( ) Exercise EKG	_____
( ) EMG	_____	( ) Treadmill EKG	_____

23. Physician's Remarks: _____

I CERTIFY THAT I HAVE REVIEWED THE FOREGOING INFORMATION SUPPLIED BY ME AND THAT IT IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT LEAVING OUT OR MISREPRESENTING FACTS CALLED FOR ABOVE MAY BE CAUSE FOR REFUSAL OF EMPLOYMENT OR SEPARATION FROM THE COMPANY. I AUTHORIZE ANY OF THE DOCTORS, HOSPITALS OR CLINICS MENTIONED ABOVE TO FURNISH THE COMPANY MEDICAL EXAMINER A COMPLETE TRANSCRIPT OF MY MEDICAL RECORD FOR PURPOSES OF PROCESSING MY PHYSICAL EXAM.

DATE _____ NAME (Print) _____

WITNESS _____ SIGNATURE _____

Physicial Examination Form

Company's Name

Last Name	First Name	Middle Name	Date of Examination	Date of Birth

2. Social Security Number

3. Height (Inches)	4. Weight	5. Temperature	6. Blood Pressure Right Left	7. Pulse/Rhythm

8. General Appearance/Hygiene	9. Nutrition	10. Build ( ) Slender ( ) Muscular ( ) Obese

11. Distant Vision: Snellen
R. 20/ _____ Corr. to 20/ _____
L. 20/ _____ Corr. to 20/ _____

12. Near Vision: Jaeger
R. _____ % Corr. to _____
L. _____ % Corr. to _____

13. Color Vision (Test & Results)	14. Field of Vision R. % L. %	15. Contact Lenses ( ) Yes ( ) No

Normal	Check each item in appropriate column (enter NE for not evaluated)	Abnormal	REMARKS
	16. Head, Face & Scalp		
	17. Neck		
	18. Eyes		
	19. Fundus		
	20. Ears - General (Int. & Ext. Canal)		
	21. Eustachian Tube Function		
	22. Drum Perforation		
	23. Nose (Septal Alignment)		
	24. Sinuses		
	25. Mouth & Throat		
	26. Lungs & Chest (Include Breast)		
	27. Heart (Thrust, size, rhythm, sounds)		
	28. Pulses (Equality, etc.)		
	29. Vascular System (Varicosities, etc.)		
	30. Abdomen & Viscera		
	31. Hernia (All Types)		
	32. Endocrine System		
	33. G-U System		
	34. Upper Extremities (Strength, ROM)		
	35. Lower Extremities (Except Feet)		
	36. Feet		
	37. Spine		
	38. Skin, Lymphatics		
	39. Anus & Rectum		
	40. Sphincter Tone		
	41. Pelvic Exam		

NEUROLOGICAL EXAMINATION

42. Sensorium _____

43. CRANIAL NERVES

I	Olfactory	VII	Facial
II	Optic	VIII	Auditory
III	Oculomotor	IX	Glossopharyngeal
IV	Trochlear	X	Vagus
V	Trigeminal	XI	Spinal Accessory
VI	Abducent	XII	Hypoglossal

44. REFLEXES: Deep Tendon (Gradation of 4)

	Right	Left
Triceps	-	-
Biceps		
Patella		
Achilles		

Pathological

	Right	Left
Babinski	-	
Hoffman		
Ankle Clonus		

Superficial

- Upper Abd.	
- Lower Abd.	
Cremasteric	

45. CEREBELLAR FUNCTION

	Yes	No
Ataxia	-	-
Tremor (Intention)	-	-
Finger to Nose	-	-
Heel to Shin (Sliding)	-	-

46. POWER & TONE OF MUSCLES
Right Upper Extremity _____
Left Upper Extremity _____
Right Lower Extremity _____
Left Lower Extremity _____

47. Proprioception-Stereognosis

	Right	Left
Joint Position Sense		
Astereognosis		
Vibratory Sensations		

48. ROMBERG SIGN

49. UNTERBURGER (If Performed)
Degrees 10 sec. _____
20 sec. _____
30 Sec. _____
Direction R L

50. NYSTAGMUS

	Yes	No
End Point	-	-
Pathological	-	-

51. SENSATIONS
Hot _____ Cold _____
Sharp _____ Soft _____
Two Point Discrimination NL _____ ABN _____

52 Additional remarks regarding abnormal findings on physical

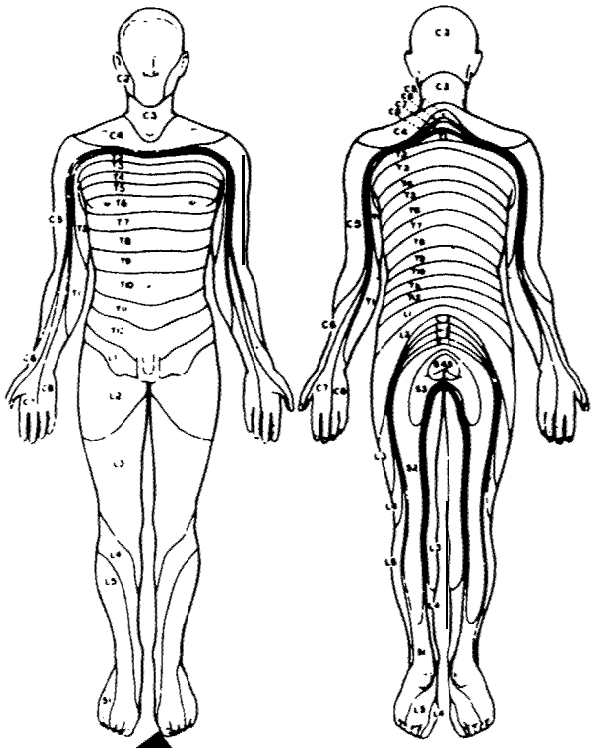

Diagram in areas of altered sensations, surgical scars, and traumatic scars.

LABORATORY FINDINGS

53. URINALYSIS

Color
Appearance
Sp. Gravity
Ph
Albumen
Sugar
Blood
Ketones
Bilirubin
Microscopic

54. BLOOD TESTS

WBC
RBC
Hct
Hb
Blood Type & Rh
Sickle Cell Index
Aids
Serology Test
Result

55. PULMONARY FUNCTION

FVC
FEV
FEV/FVC

56. X-RAY

Chest (1 x 17)
Lumbosacral Spine
Upper GI Series
Other

57 ELECTROCARDIOGRAM

Static
Stress or Exercise

58. AUDIOGRAM PURE TONE

HZ	500	1000	2000	3000	4000	6000	8000
Right							
Left							

59. SMA-12

60. Drug Screen

The examinee is
( ) Fit for diving
( ) Fit for employment
( ) Unfit

This certificate is issued subject to condition(s) that:
( ) No restrictions
( ) Restrictions:

Summarize findings resulting in disqualification:

Date of Examination

Name of Examinee

Name and Address of Physician (Print/Type)

Signature of Physician

Area Code; Telephone Number

Chapter Three

OPERATIONS PROCEDURES

Fourth Edition, 1992

I. General Operations Procedures

A. Safe Practices/Operations Manual

1. Each employer shall develop and maintain a Safe Practices/Operations Manual as required by governmental regulations which shall be made available at the dive location to each dive team member. This manual must provide for the safety and health of the divers. The Safe Practices/Operations Manual shall meet or exceed the requirements of the ADC *Consensus Standards for Commercial Diving Operations*.

2. The *ADC Consensus Standards for Commercial Diving Operations* may be used as a set of minimum guidelines to assist diving companies in developing their own specific Safe Practices/Operations Manual. Each employer is responsible for completing. modifying and/or complementing any of the procedures, checklists and standards in accordance with applicable governmental regulations and as dictated by the specific policies and practices of the employer.

B. Emergency Aid.

1. Each employer shall develop and maintain a list of the available sources of emergency aid, equipment and professional assistance with their call signs or phone numbers and instructions for establishing contact with them.

2. Each contractor shall make the list available at the company's principal place of business, at the field operations office. and to those who may have need for it to fulfill the company's emergency response plan.

3. The List shall include information necessary for the requisition of. or access to, the following types of emergency aid appropriate for the type of diving operations engaged in:
   - Decompression chamber (when not otherwise required by paragraph "G" of this section)
   - Hospital or medical treatment facility
   - Air or ground transportation
   - On-call physician
   - U.S. Coast Guard Rescue Coordination Centers

4. Two-way communications shall be available and accessible at any diving or hyperbaric work site in order to engage emergency services as required.

C. First Aid

1. First aid supplies appropriate for the type of operation being conducted shall be provided and kept readily accessible at the work site.

2. 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.

D. Planning and Assessment

Planning of a diving operation shall include a Job Hazard Analysis (see X, page 3-9) of the safety and health aspects of the following:

- Diving mode
- Surface and underwater conditions and hazards
- Breathing gas supply (including reserves)
- Thermal protection
- Diving equipment and systems
- Dive team assignments and physical fitness of dive team members including any conditions which may render an individual dive team member unfit to dive
- Repetitive dive designation or residual inert gas status of dive team members
- Decompression and treatment procedures (including altitude corrections)
- Emergency procedures

E. Dive Team Briefing

1. Dive team members shall be briefed on:
   - The tasks to be undertaken
   - Safety procedures for the diving mode
   - Any unusual hazards or environmental conditions likely to affect the safety of the diving operations
   - Any modifications to operating procedures necessitated by the specific diving operations

2. Before each dive the diver shall be instructed to report any physical conditions, problems, or adverse physiological effects that may render him unfit to dive.

F. Termination of Dive

The working interval of a dive shall be terminated when:

- Directed by the dive supervisor and/or the person in charge
- The diver requests termination
- The diver fails to respond correctly to communications or signals from a dive team member
- Communications are lost and can not be quickly re-established between the diver, the tender, the diving supervisor and, in liveboating operations, the person controlling the vessel

- The diver begins to use the diver-carried reserve breathing gas or the dive-location reserve breathing gas

G. Post Dive Procedures

1. After the completion of each dive the diver shall:
   - Be questioned as to his physical condition
   - Instructed to report any physical problems or adverse physiological effects including symptoms of decompression sickness or gas embolism
   - Advised of the location of an operational decompression chamber

   Alerted to the potential hazards of flying after diving

2. After the completion of any dive outside the no-decompression time/depth limits, the following are recommended:
   - Take reasonable steps to have the diver remain awake and in the vicinity of the decompression chamber for at least one hour
   - Instruct such divers to remain within two hours' travel time of the decompression chamber for an additional five hours
   - Instruct such divers of the hazards of flying at altitudes in excess of 800 ft., except in an emergency within:
     - 12 hours after decompression from a non-saturation dive
     - 24 hours after decompression from a HeO_2 saturation dive

3. On any dive that results in decompression sickness, proper medical authority should be consulted prior to flying after treatment.

H. Hazards to Diving Operations

1. Notice shall be given of the planned diving operations, including the daily start and finish times, to those in the vicinity whose activities may interfere with or pose a hazard to the diving operations. These activities include underwater demolition operations, movement of surface vessels, or lifting of material directly over the diving operations.

2. Diving operations shall not take place wherever hazardous activities or conditions in the vicinity pose a safety hazard to the diver or impair the support personnel from safely carrying out their work tasks.

3. In no case shall the diver be required to dive against his will.

I. Underwater Hazardous Conditions

Before any underwater task a Job Hazard Analysis (JHA) shall be performed (see X, page 3-9). The purpose of this analysis will be to determine underwater hazards, including but not limited to:

Potential for diver fouling or entrapment

- Differential pressure hazards including but not limited to:

- Underwater discharges, dredging, major intakes, pumps, sluices, suctions or valve culverts
- Any activity that would expose the diver to differential pressure

- Lockout/tagout of hazardous energy situations including but not limited to:
  - Active cathodic protection, high intensity sonars, propellers, pumps, vessels, or any mechanical apparatus whose inadvertent operation would be hazardous to the diver
  - All such devices shall be deactivated and their controls tagged prior to the commencement of the diving operation
- Diving in contaminated liquid, including but not limited to:
  - Chemical, micro-biological or radiological contamination
  - Any thermal or toxic threat to the diver
- Limited access or penetration situations. A diver entering a pipe, tunnel, wreck, or similarly enclosed or confining structure, (other than a habitat), shall:
  - Have an underwater tender at the point of entry
  - Be equipped with an appropriate diver-carried reserve gas breathing supply
- Operations involving explosives

3. Temporary Impairment or Condition

Divers shall not dive or be otherwise exposed to hyperbaric conditions for the duration of any known temporary impairment or condition, if such is likely to adversely affect health or interfere materially with the person's ability to perform a specific diving task or safely be exposed to hyperbaric conditions. The-se include but are not limited to colds, alcoholic intoxication or its after-affects, influence of drugs, pregnancy, respiratory or middle ear diseases, skin or external ear infections, or excessive fatigue or emotional distress. The diver should be consulted before making such determination. In no case shall the diver be required to dive or be exposed to hyperbaric conditions against his will, except for treatment procedures.

K. Inspection of Systems, Equipment, and Tools

1. Before diving operations commence, personnel shall confirm that all operational systems, equipment and tools used in diving operations are in working order, appropriate for the tasks and in compliance with the Chapter 4, "Diving Equipment and Systems" (Pages 4-3 ff).

2. Operational systems, equipment and tools used in diving operations should be inspected each day and monitored throughout the operations by designated persons.

3. Each person engaged as a diver in the diving operation shall inspect his personal diving equipment and confirm its operational readiness prior to each use.

L. Entering and Leaving the Water

There shall be a safe means for entering or leaving the water from the diving platform, such as a ladder, stage, or other appropriate device. This device shall extend a minimum of three feet below the water surface. Additionally, the means of entering and leaving the water shall be adequate to facilitate rescue of personnel.

M. Decompression Chamber

1. For any dive in excess of 80 fsw, dives deeper than 60 fsw when liveboating, or dives requiring decompression there will be provided a dual-lock decompression chamber having a minimum capability of 6 ATA (equivalent to 165 fsw) ready for use at the dive site.

2. Prior to mobilization on jobs not normally requiring a decompression chamber, a Job Hazard Analysis shall be performed to determine whether a decompression chamber will be required at the dive location, including but not limited to:

   - Dive site location
   - Multi-day and/or repetitive diving operations
   - Potential for diver fouling or entrapment
   - Other potential hazards or factors which may cause the diver to incur decompression obligations
   - Liveboating operations

N. Diving at Altitude

For any diving operation conducted at an elevation significantly above sea level, decompression procedures which take the reduced surface pressure into account shall be utilized.

O. Thermal Exposure

Additional precautions should be taken to protect the diver from adverse thermal exposure while engaged in diving.

P. Stand-by Diver

When assigned, a stand-by diver will be on deck, suitably dressed and ready to dive.

Q. Warning Display

For areas which support marine traffic, an appropriate warning display shall be exhibited near the work site so that it has ah-around visibility. This may include but is not limited to shapes, lights, flags or placards. See Appendix C, (Page 6-30), for more information.

R. Reserve Breathing Supply

1. A diver-carried reserve breathing supply must be provided when diving deeper than 60 fsw, on dives requiring decompression regardless of depth, when direct ascent to the surface is not available, or when bell diving, except where heavy gear is worn.

2. A diver-carried reserve breathing gas supply shall supply a physiologically appropriate mixture for the depths involved.

3. Diver-carried reserve breathing gas supplies must provide a positive indication to the diver that his reserve has been actuated. Such an indication can be the requirement for the diver to open a valve, a visual signal or other appropriate methods.

4. The diver-carried reserve breathing supply shall be of sufficient duration for use until the diver can reach the surface, reach another source of breathing media or be reached by the standby diver equipped with another source of breathing media.

5. In all cases the activation of the diver's reserve shall cause the dive to be aborted. The reason for activation of the diver's reserve must be ascertained and corrected prior to continued use of the involved equipment.

S. Communications

There shall be an operating two-way audio-communication system between the diver and a dive team member at the dive location, except as permitted by paragraph II,B,1, "SCUBA", in *Specific Operations Procedures* (Page 3-22).

T. Company Record of Dives

Each employer shall establish and maintain a record of each diver's hyperbaric exposure. This record shall contain the following:

- Name and address of the company
- Location, time and date of diving operations
- Names of the dive supervisor, diver and tender
- Depth of dive
- Bottom time
- Approximate water temperature and thermal protection used
- Environmental conditions (approximate sea state, underwater visibility, and underwater currents)
- Decompression tables and schedule used
- Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation
- Breathing mixture used and composition
- Type of work performed
- Type of diving equipment worn
- Any unusual conditions
- For each dive for which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:
  - Description of decompression sickness symptoms including depth and time of onset
  - Description and results of treatments

U. Decompression Procedure Assessment

Each employer shall:

- 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
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness

V. Positioning

Vessels from which diving operations are conducted shall afford a safe working platform. Safe operations from dynamically positioned vessels are covered elsewhere in these standards.

W. Personal Protective Equipment

1. The appropriate ANSI approved personal protective equipment shall be worn when required These items include but are not limited to:
   - Protective head gear
   - Protective foot wear
   - Protective eye wear
   - Personal flotation device to appropriate regulatory standard
   - Hearing protection
   - Safety harness with approved double locking elastic lanyard
   - Respiratory equipment
2. Appropriate personal protective clothing shall be worn as necessary to provide protection against hazards encountered in the work environment.

X. Job Hazard Analysis (JHA)

The purpose of the Job Hazard Analysis is to identify hazards associated with each step of a job, and to develop solutions that will either eliminate or guard against the hazard. Keep the sentences short and simple.

1. Sequence of Basic Job Steps

Break the job into observable steps. Try not to be too general or detailed.

- If the job is complex break it into several tasks: prepare a JHA for each task.
- Begin with an active verb, e.g., disconnect, check, invert, assemble, isolate, start, stop, etc.
- Number each step

2. Potential Hazards

Identify possible hazards associated with each step. List opposite job step.

- Consider potential accident causes (strain, sprain, slip, fall, cut, crush, etc.>
- Consider environmental and health hazards (vapors, gases, heat, noise, toxicity, etc.)

3. Recommend Safe Procedures and Protection

Develop solutions for each potential hazard. List opposite hazard.

- Detail controls, e.g., ventilate, isolate, allow to cool, secure, guard train, etc.
- List personal protective equipment (PPE) required, e.g., gloves, eye protection, respirators, fall protection, etc.

4. Assign Responsibility

- Assign a specific person the responsibility for implementing the safe procedures or protection required.

5. Personnel Involved

- Identify the persons preparing, reviewing and approving the Job Hazard Analysis.
- Distribute the JHA to all personnel involved in the job or task.

6. Revising the Job Hazard Analysis

The JHA should be reviewed and updated periodically whenever new equipment, products, or procedures are introduced into the work site. This is especially true if an accident has occurred on a task that has had a JHA performed.

Y. Job Hazard Analysis Form

The ADC Job Hazard Analysis form on the following page can be copied and used as is, or modified to suit individual company needs.

JOB HAZARD ANALYSIS

(SEE INSTRUCTIONS ON REVERSE SIDE)

Company:	Location:	Date: Page ____ of ____	New / Revised

Job or Task:

#	Basic Job Steps	Potential Hazards	Recommended Safe Procedures / Protection	Responsibility

Prepared By:	Reviewed By:	Approved By:

Distribution

ADC-JHA-7/92

ASSOCIATION OF DIVING CONTRACTORS, INC.

Instructions for Completing a Job Hazard Analysis (JHA)

The purpose of the Job Hazard Analysis is to identify hazards associated with each step of a job, and to develop solutions that will either eliminate or guard against the hazard. Keep the sentences short and simple.

Sequence of Basic Job Steps

Break the job into observable steps. Try not to be too general or detailed.

- If the job is complex, break it into several tasks: prepare a JHA for each task.
- Begin with an active verb, e.g., disconnect, check, invert, assemble, isolate, start, stop, etc.
- Number each step

Potential Hazards

Identify possible hazards associated with each step. List opposite job step.

- Consider potential accident causes (strain, sprain, slip, fall, cut, crush, etc.)
- Consider environmental and health hazards (vapors, gases, heat, noise, toxicity, etc.)

Recommend Safe Procedures and Protection

Develop solutions for each potential hazard. List opposite hazard.

- Detail controls, e.g., ventilate, isolate, allow to cool, secure, guard, train, etc.
- List personal protective equipment (PPE) required, e.g., gloves, eye protection, respirators, fall protection, etc.

Assign Responsibility

- Assign a specific person the responsibility for implementing the safe procedures or protection required.

Personnel Involved

- Identify the persons preparing, reviewing and approving the Job Hazard Analysis.
- Distribute the JHA to all personnel involved in the job or task.

Revising the Job Hazard Analysis

The JHA should be reviewed and updated periodically whenever new equipment, products, or procedures are introduced into the work site. This is especially true if an accident has occurred on a task that has had a JHA performed.

II. Assignments and Responsibilities

Titles, duties, responsibilities and capabilities of personnel engaged in commercial diving vary widely. The employer is responsible for assigning personnel to a diving operation and will ensure all personnel are qualified by training and/or experience to perform the tasks they are assigned. The following designations indicate the minimum duties and responsibilities of dive team members.

A. Diving Supervisor

A qualified person shall be designated in writing, to be in charge of each diving operation.

The Diving Supervisor is in charge of the planning and execution of the diving operation, including the responsibility for the safety and health of the dive team. In carrying out these responsibilities, his duties shall include but not necessarily be limited to the following:

- Be fully cognizant of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed, and the employer's Basic Safe Practices/Operations Manual. See that all rules and regulations are followed.
- While actually on duty, be in immediate control and available to implement emergency procedures. The dive supervisor is not permitted to dive unless another qualified supervisor or lead diver is present who has also been appointed and designated to assume responsibility.
- Ensure prior to diving, in addition to parties directly involved in thediving operation, that masters of craft, pilots of submersibles, harbor masters, managers of offshore installations, pipelines, civil engineering sites and inland watetways, and all persons responsible for anything that affects the diving operation are advised that diving operations are to be undertaken. Provide a copy of the Safe Practices/Operations Manual to the person in charge of the vessel or facility, with written modifications necessitated by specific operating conditions.
- Ensure diving operations are carried on from a suitable and safe location on the surface.
- Develop or modify and produce pre and post dive check lists for his operation.
- Develop and implement emergency/contingency procedures
- Be aware of the procedures to follow to obtain medical support in the event of an accident, either diving or non-diving related. Ensure a two-way communication system is available at the dive location to obtain emergency assistance.
- Perform a Job Hazard Analysis for each task undertaken.
- Establish a dive plan ensuring that sufficient breathing mixtures, supplies and proper equipment are available for safe and timely completion of the job task.
- Personally verify that all personnel in the dive team are qualified and physically able to perform tasks assigned. He must make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present which

would be detrimental to their health and safety in the water or under hyperbaric conditions.

- Assign the duties of ah members of the dive team and personally direct them throughout the diving operation.
- Ensure that the diving equipment designated for use is:
  - suitable for the planned diving operation
  - sufficient to regulatory requirements for the diving mode used
  - inspected prior to each dive and in good working order
- Ensure that all relevant operating instructions, manuals, decompression tables, treatment schedules, and regulatory publications are available at the dive location and are maintained to reflect current changes and/or developments.
- Ensure the detailed briefing of his diving team and support personnel including:
  - tasks to be undertaken
  - unusual hazards or environmental conditions
  - modifications to standard procedures or safety procedures necessitated by the specific diving operation
- Maintain a depth, bottom time and breathing mix profile at the dive location for each diver during the dive,
- Ensure that each diver is continuously tended while in the water.
- Ensure the dive is terminated when:
  - The diver requests termination
  - The diver fails to respond to communication or communication is lost between the diver and dive team members at the dive location.
  - Communication is lost between the person in charge and the diving supervisor during liveboating operations.
  - The diver begins to use his diver-carried reserve breathing gas supply.
- Ensure after every dive:
  - The physical condition and well being of the diver is checked by visual observation and verbal questioning.
  - The diver is instructed to report any physical problems or symptoms of decompression sickness or arterial gas embolism,
  - The diver is advised of the location of the nearest operating decompression chamber.
  - The diver is acquainted with the dangers of flying after diving or travelling to altitudes higher than the dive site.
- Ensure after any treatment or dive outside the no decompression limits:
  - The diver is instructed to remain awake and in the vicinity of a decompression chamber for at least one hour.
  - a trained dive team member is available to operate the decompression chamber.
- Report all accidents or incidents involving personnel as required by employer rules and relevant governmental regulations.

- Maintain and submit reports required by employer and relevant governmental regulations concerning diving operations and equipment maintenance, testing or repair.

B. Diver

The diver is assigned by the supervisor to perform specific tasks underwater and topside.

A diver shall be at least 18 years old, be medically certified "fit to dive", have a knowledge of diving theory and practice, a full understanding of the diving equipment in use, and of the tasks assigned. All divers should be in possession of an up-to-date diver's log book which can be used to establish levels of experience.

Each diver in the carrying out of his duties and responsibilities shall:

- Accomplish all tasks assigned by the diving supervisor. In the event he is assigned a task for which he does not consider himself qualified either by training and/or experience, he shall immediately inform the diving supervisor.
- Read, understand and comply with all employer's policies and with applicable governmental regulations as they relate to his qualifications or performance while engaging in diving operations.
- Maintain a high level of physical fitness.
- Immediately obey all commands or instructions from the diving supervisor to return to the surface, first decompression stop, or bell.
- Ensure that the deepest depth of his dive has been established before his ascent.
- Safely transition from the water to the decompression chamber without avoidable delay.
- Act as a standby diver when directed to do so. While acting as standby diver, the diver shall:
  - be dressed sufficiently to allow immediate entry into the water, and to stay at depth as long as circumstances require
  - remain at his station throughout the entire dive and in-water decompression
  - monitor the dive radio to constantly remain abreast of events of the dive
- Not be assigned any tasks that might interfere with his duties as standby diver while there is a diver in the water.
- Act as a chamber operator as required by the diving supervisor.
- Comply with regulations or instructions concerning the use, maintenance, repair and testing of all diving equipment provided for the opention.
- Report to the diving supervisor any recent medical treatment or illness so that a proper determination can be made concerning his fitness to dive.
- Immediately report all symptoms or suspected symptoms as early and accurately as possible.
- Report to the diving supervisor any defect or malfunction of the diving equipment provided for the diving operation.

- Follow safe diving practice at all times during the diving operation whether on deck or in the water. Bring to the attention of the diving supervisor any questionable items. Be alert for the safety of others as well as himself.
- Assist in the training of new personnel or tenders.
- Remain awake and in the vicinity of the decompression chamber for at least one hour following treatment or a hyperbaric exposure outside the no decompression limits.
- Know and observe the rules for flying after diving or travelling to altitudes higher than the dive site.
- Ensure that his diving equipment has been correctly maintained, prepared and tested before each dive. This requirement should never be delegated to others.
- Maintain a diver's log book which details all dives, medical examinations, courses taken, and personal equipment maintenance.
- Ensure their medical certificates are up-to-date and recorded in their diver's logbook. Present their logbook to the diving supervisor on every job.
- Maintain certification in First Aid and CPR.

C. Tender

The tender is assigned by the diving supervisor to continuously tend a diver. .He shall devote his full time and attention to tending the diver he is assigned to from the preparation of the dive until its completion including any in-water decompression required. He shall not be assigned any other task while the diver is under water. He should further:

- Assist the diver in dressing and undressing, and confirm that the diver's equipment is functioning properly.
- Tend the diver's umbilical and be aware of the diver's depth and location at all times.
- Set up and operate all equipment as directed by the supervisor or his representative.
- In the event he is assigned a task for which he does not consider himself qualified either by training and/or experience, he shall immediately inform the diving supervisor or his representative.
- Perform routine maintenance on diving equipment.
- Repair such equipment as he is qualified and checked out to repair.
- Assist in topside work as required or directed.
- Be alert for and immediately report conditions which may be hazardous or unsafe.
- Maintain certification in Fit Aid and CPR.

As a tender gains more experience his areas of responsibility will expand. His duties and responsibilities may include:

- When qualified, properly operate a decompression chamber as required for decompression or treatment. As a decompression chamber operator, he shall be responsible for:
  - Maintaining the proper depth in the chamber as required by decompression schedule or treatment protocol.
  - Maintaining a proper ventilation schedule so oxygen and carbon dioxide levels remain within safe limits.

- Decompress or treat the diver in accordance with the schedule as directed by the diving supervisor.
- Maintain communication with the chamber occupants.
- Properly complete all paperwork as required by employer policy and/or governmental regulations.
- While operating the chamber, the tender shall not be assigned to any other task.

- Before being exposed to hyperbaric conditions, the tender must be medically certified "tit to dive."
- Perform limited tasks as a diver when directed by the supervisor. A tender that dives shall be subject to the duties and responsibilities of a diver within the limitations of his assignment.
- When required, ride the chamber with the diver during decompression or treatment. This inside tender must be familiar with and alert for the symptoms of oxygen toxicity.

D. Life Support Technician

The Life Support Technician is directly responsible to the diving supervisor. He must possess the knowledge and ability to perform the duties listed below within the scope of his assignment. This knowledge and skill will have been obtained by a combination of formal training, and on site experience and training. It is recommended that Life Support Technicians maintain a personal logbook which includes details of work experience and qualifications. The duties and responsibilities of the Life Support Technician will vary depending on the diving mode employed but at a minimum he shall:

- Conduct such operations as may be required or directed by the diving supervisor.
- Perform assigned diving support tasks
- Maintain adequate supply of the correct breathing mixture to the diver.
- Maintain correct supply over-pressure for depth and apparatus.
- Have standby banks ready.
- Follow the tables in use correctly and accurately.
- Switch breathing mixtures at the proper time and depth
- Record gas consumption data as directed
- Assist in the maintenance of all diving equipment
- Assist in the training of tenders and new personnel
- Report any potentially unsafe situations or conditions to the diving supervisor
- Maintain certification in First Aid and CPR, and have a thorough working knowledge of emergency procedures and the diagnosis and treatment of decompression sickness.

In the saturation diving mode the Life Support Technician is employed primarily to control and constantly monitor the hyperbaric environment and system in which divers live while saturation diving. His duties in this diving mode include, but are not limited to:

- Maintain proper atmosphere, (i.e., correct levels of oxygen, carbon dioxide and other gases), and pressure in the saturation complex according to employer's policy and as directed by the diving supervisor.

- Maintain proper environment, (i.e., temperature and humidity), at levels suitable for current depth as the diver's comfort dictates.
- Decompress divers according to established schedules as directed by the diving supervisor.
- Maintain communication with divers.
- Calibration at regular intervals of all monitoring instruments which require, by their design, periodic calibration or at any time the accuracy of the instrument is suspect.
- Maintain an accurate record of events, in the form of a saturation log, appertaining to the diving system. All readings taken and actions during the shift must be entered in the log. They should include:
  - oxygen and carbon dioxide readings
  - depth changes, temperature and humidity readings
  - gas changes, and BIBS usage details
  - carbon dioxide scrubber changes
  - medical lock runs, with record of items locked in or out
  - individual diver's sleep cycles
  - showers, flushes, and drains
  - calibration of instruments
  - bell on and off system and crew TUP's
  - changes to settings on the environmental control system, record of equipment status
  - chamber hygiene and disinfection, divers ear prophylaxis
  - any event outside normal chamber routines
- Require that diver's requirements within the diving complex together with matters that concern diver's safety and well being are promptly carried out. These include such items as - food, drinks, entertainment, personal hygiene and laundry, sanitary matters, etc.
- Be aware at all times of all items being sent in or out of the system, and supervise all such operations. Prevent prohibited items from entering the system.
- Advise the diving supervisor of diver's status at regular intervals or as conditions dictate.
- Be alert for emergencies.
- Keep traffic in the control van to a minimum.
- Be aware at all times of the actions carried out by personnel temporarily under his supervision. He must be informed beforehand of any activity to be carried out on the diving complex, its support equipment, or in it's near vicinity by other personnel.

III. Safety Procedures Checklist

The following are minimum guidelines that may require modification for each diving mode to meet individual company needs.

A. Safe Practices/Operations Manual

- Safety Procedure Check List
- Dive Team Member Assignments and Responsibilities
- Equipment Procedures and Check List
- Emergency Procedures for Fire, Equipment Failure, Adverse Environmental Conditions, Medical Illness/Injury
- Specific Individual Procedures for Tools, Equipment and Associated Systems
- Available at the dive site to dive team members
- Copy to the Person in Charge of the Vessel or Facility

B. Emergency Aid

- Decompression chamber (off-site)
- Nearest hospital/medical treatment facility
- Air or ground emergency transportation
- On call physician
- US Coast Guard Rescue Coordination Centers
- Emergency rescue source other than US Coast Guard
- Two-way communications available on-site and tested to emergency response link

C. First Aid

- First Aid Kit
- First Aid Manual
- Bag-type Manual Resuscitator

D. Planning and Assessment

- Job Hazard Analysis
- Diving mode/equipment/system(s)
- Means of water entry and esit
- Breathing gas supplies including reserves (set up and tested)

- Thermal protection (all dive team members)
- Dive team assignments/briefing and fitness to dive
- Inert gas status of dive team members (repet designations)
- Decompression and/or treatment procedures (including altitude)
- Communications procedures and methods to all personnel involved in the diving operation
- Emergency Procedures
- Dive station set up
- Any necessary modifications to the Safe Practices/Operations Manual
- Written designation of the Diving Supervisor given to the Person in Charge of the Vessel or Facility
- Report on the nature and planned times of the planned diving operation, and the planned involvement of the vessel or facility's equipment and personnel to the Person in Charge

E. Hazards to Diving Operations

- Surface vessel traffic and/or vehicular traffic
- Overhead crane/gantry operations
- Pedestrian traffic
- Displayed diver signals
- Critical Dive System to Vessel or Platform Interfaces tagged and non dive team personnel briefed

F. Underwater Hazardous Conditions

- Diver fouling and/or entrapment
- Differential pressures
- Lockout/Tagout
- Contaminated/toxic liquid
- Limited access/confined space/penetration
- Use of explosives or seismic activities
- Underwater sonar
- Cathodic protection

G. Record Keeping

- Project description/accomplishment records completion
- Diving and treatment records, accident reports
- Individual dive logs entry completions

IV. Equipment Procedures Checklist

The following are minimum guidelines that may require modification for each diving mode to meet individual company needs.

A. Equipment Preparation

1. Assemble and lay out all dive equipment, both primary equipment and spares for divers, including all accessory equipment and tools.

2. Check all helmets and masks.

B. General Equipment

1. Check that all accessory equipment - tools, lights, special systems, spares, etc. - are on site and in working order.

C. Preparing the Breathing Gas Supplies

1. Check that a primary and suitable back-up supply is available with a capacity in terms of purity, volume, content and supply pressure to completely service all divers, including decompression, recompression and accessory equipment throughout all phases of the planned operation.

2. Verify that all breathing gas supply systems have a suitable volume tank installed in the air supply line between the supply source and diver's hose connection. A filtration system must be installed between the volume tank and the air source.

3. Verify that all supply hoses running to and from compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends, and are not exposed on deck in such a way that they could be rolled over, damaged or severed by machinery or other means.

4. Verify that all pressure supply and interface hoses have safety lines and strain reliefs properly attached.

5. Compressors

   - Determine that sufficient fuel, coolant, lubricants and anti-freeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated and serviced (with all spillage cleaned up completely).
   - Verify that oil in the compressor is an approved type. Check that compressor oil does not overflow Fill Mark; contamination of air supply could result from fumes or oil mist.
   - Check that compressor exhaust is vented away from work area and specifically does not foul the compressor intake.
   - Check that compressors are not covered during operation.

- Check all filters, cleaners and oil separators for cleanliness.
- Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs.
- Check that all valves are properly aligned.
- Check that all belt-guards are properly in place on drive units.
- Check all pressure-release valves, check valves and automatic unloaders.

D. Activate the Breathing Gas Supplies

1. Compressors

- Ensure that all warm-up procedures are completely followed.
- Check all petcocks, filler valves, filler caps, overflow points, bleed valves and drain plugs for leakage or malfunction of any kind.
- Leak check all valves and connections.
- Verify that there is a properly functioning pressure gauge on the air receiver and the compressor is meeting its delivery requirements.

2. Cylinders

- Check all cylinders for proper pressure.
- Verify availability and suitability of reserve cylinders.
- Check all manifolding and valving for operation.
- Activate and check delivery.

E. Breathing Gas Hoses

1. Ensure all hoses have a clear lead and are protected from excessive heating or physical damage.

2. Check breathing gas hoses and fittings for leaks and flow,

F. Test of Equipment with Activated Breathing Gas Supply

1. Check all exhaust and non-return valves.

2. Hook up all breathing gas hoses to helmets, masks and chamber; make connection between back-~ supply and primary supply manifold.

3. Ensure breathing gas mixture is suitable for depth and diving mode used.

4. Verify flow to helmets and masks.

5. Hook up and test all communications.

6. Check breathing gas flow from both primary and back-up supplies to chamber.

G. Decompression Chamber Checkout (Predive Only)

1. Check that chamber is completely free and clear of all combustible materials.
2. Check primary and back-up air supply to chamber and all pressure gauges.
3. Check that chamber is clean and free from contaminants.
4. Check all chamber BIBS supplies. Verify that sufficient appropriate breathing media is available
5. Verify that medical kit is available and in close proximity to the chamber.
6. Check all doors and seals.

H. Final Preparations

1. Verify that all necessary records, logs and timesheets are on the diving station.
2. Check that appropriate decompression and treatment tables are readily at hand.

V. Specific Operations Procedures

A. Introduction

The specific operations procedures vary with the type of diving mode employed. Prior to mobilization a Job Hazard Analysis shall be performed to determine the type of diving mode to be employed, equipment needed and job manning requirements.

B. Self-Contained Diving (SCUBA)

The following are minimum requirements for self-contained diving operations.

1. Audio communications are not required for a diver who is accompanied by another diver (buddy) or who can communicate with the tender on the surface through a safety line using pull signals.

2. The planned time of such a diving operation shall not exceed the no decompression limits or the air supply duration of the cylinders exclusive of the reserve supply. The cylinder pressure shah be determined immediately before each dive. Dive depths shall not exceed 130 fsw.

3. Each diver shall be equipped with a kniie, a diving wrist watch and a depth gage.

4. A weight belt with a quick release shall be worn which is appropriate for the suit and depth of the dive.

5. A cylinder harness with a quick release shall be worn to secure the breathing mixture cylinders to the diver.

6. The weight belt and cylinder harness shall be independently attached to permit release of either one without interference by the other.

7. A personal flotation device shall be worn except for diving in enclosed spaces.

8. Compressed breathing gas cylinders shall be:
   a. Annually inspected internally and externally for corrosion and pitting. If a defect is found that may impair the safety of the pressure vessel, then a hydrostatic test must be performed.
   b. Annually tested by a pneumatic and leak test using the breathing mixture normally used. Pressurize the cylinder to the maximum allowable working pressure stamped on the vessel and hold for l0 minutes, testing for leaks.
   c. Hydrostatically tested every 5th year. A hydro must also be performed when any repair, modification or alteration affects the pressure boundary. The test must be to I ¼ or 1½ times the pressure stamped on the vessel, depending on which code it was built to.
   d. Removed from service if they do not meet the requirements of the hydrostatic test, Results of inspections and tests shall be recorded in the equipment log.
   e. Filled from a compressed gas system equipped with a relief device that controls the maximum filling pressure.

9. SCUBA dives shall not be conducted against currents cxcccding one (1) knot.

10. SCUBA dives shall not be conducted in enclosed or physically confined spaces.

11. During all SCUBA dives, a stand-by diver shah be available while a diver is in the water

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

13. SCUBA divers shall be equipped with a diver-carried reserve breathing gas supply.

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

C. Surface-Supplied Diving

The following arc minimum requirements for surface-supplied diving operations.

1. The approximate depth of each dive shall be determined prior to the start of operations.

2. A weight belt appropriate for the suit and depth of the dive shall be worn, except when conditions dictate otherwise for the safety of the diver.

3. A separate safety harness with a positive buckling device shall be worn. The harness shall distribute the load of the diver's body, and shah prevent any strain from being placed on the diver's mask or helmet when the umbilical attached to the lift ring on the harness is pulled, Except for heavy gear diving, harnesses should be worn under all other types of equipment.

4. Air dives shall not exceed 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

5. The breathing mixture supplied to the diver must be composed of a mixture of gases that is appropriate for the depth of the dive.

6. Mised gas shall bc used as the breathing mixture for dives deeper than 220 fsw

7. A decompression chamber shall bc ready for use at the dive location as required by item "M", (Page 3-7).

8. Each diver shall bc continuously tended while in the water by a separate dive team member.

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

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

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

D. Air Diving

The following are minimum requirements for surface-supplied air diving operations.

1. Minimum Personnel

a. Surface-Supplied Air Diving 0 - 80 fsw, with no decompression:

- 1 - supervisor
- I - diver
- 1 -tender

(1) May be reduced in OSHA waters by 1 diver when (2) does not apply. (Do a JHA.)

(2) An additional dive crew member is recommended when any diving operation which has an increased likelihood of diver entrapment or potential for rendering the diver unconscious or incapacitated from chemical, physical, electrical or topside hazards such as but not limited to the following is present or planned:

- Diving in remote locations where assistance from non-diving crew personnel is not immediately available, i.e., within communication range of the tender
- Penetration diving, both horizontal or vertical
- Any crane/tugger operations associated with the diving operation
- The use of any surface tended equipment by the diver. This includes hand jetting, water blasting, cutting and welding or any pneumatic or hydraulically operated tool.
- Diving from any platform with an extended air gap to the water

b. Surface-Supplied Air Diving 80 - 130 fsw, or less than 80 fsw when decompression is required, or when penetration diving:

- 1 -supervisor
- [illegible]
- 2 -tenders

c. Surface-Supplied Air Diving 130 - 220 fsw:

- 1 - non-diving supervisor
- 2 - divers
- 2 -tenders

d . Shallow Operations With Large Crews

When a diving operation takes place in less than 130 fsw and the on-shift crew size is eight (8) or more, then a non-diving supervisor must be part of the crew.

For example:

- When two (2) eight man diving crews are working on different shifts on a single vessel or facility, a non-diving supervisor is required on each shift.
- When two (2) four man diving crews are working on the same shit at different locations on a single vessel or facility, a non-diving supervisor is required.

- When two (2) four man diving crews are working on different shifts on a single vessel or facility a non-diving supervisor is not required. as there are only four people on deck at any time.

2. Minimum Qualifications of Personnel

a . Supervisor

Must have training or experience in the following areas:

- Air diving procedures and techniques
- Emergency procedures
- Physiology as related to diving
- Diving accident treatment proccdurcs
- Proper operation and use of all equipment related to air diving including decompression chambers

b. Non-Diving Supervisor

A non-diving supervisor is dctincd as an experienced supervisor in accordance with the minimum qualifications who is not in the diving rotation.

c . Diver

Must have training or experience in the following areas:

- Air diving procedures and techniques
- Emergency procedures
- Diving accident treatment proccdurcs
- Proper operation and use of all equipment related to air diving including decompression chambers
- Have experience in the USC of air diving equipment
- Familiarity with the type of work engaged in

d. Tender

A Tender must have the same qualifications as an air diver, with a lower level of experience required.

3. Minimum Equipment

a. Shallow Air (0 to 80 fsw, 60 fsw when liveboating), with no decompression

- Adequate air source and volume tank to support two (2) divers
- Dive location emergency air source
- 2 diving hose groups, each consisting of:
  - Air hose
  - Strength member
  - Communications cable
  - Pneumofathometer hose
- 1 set air decompression and treatment tables
- 1 Safe Practices/Operations Manual
- 1 control station consisting of:

  - Communications system
  - Depth gauges
- 1 diving ladder or other safe means of getting a diver out of the water
- 1 basic first aid kit
- 2 sets of diver's personal diving equipment consisting of:
  - Helmet or mask
  - Weight belt if appropriate
  - Protective clothing
  - Tools as required
  - Safety harness
  - Diver-carried reserve breathing gas supply (bailout)
  - Knife
- 2 time-keeping devices
- A log book and/or dive sheets

b. Deep Air (in excess of 80 fsw, 60 fsw liveboating). All dives outside no decompression limits

- 2 adequate air sources
- 2 volume tanks
- 1 double lock decompression chamber
- 1 set air decompression and treatment tables
- 1 diving stage (all dives deeper than 100 fsw, outside no decompression limits, or with heavy gear)
- 2 hose groups consisting of:
  - Air hose
  - Strength member/strain relief
  - Communications cable
  - Pneumofathometer hose
- 1 control station consisting of:
  - Communications system
  - Depth gauges
- 2 time-keeping devices

- 1 basic first aid kit
- 2 sets of divers personal diving equipment consisting of
  - Mask or helmet
  - Weight belt if needed
  - Diver-carried reserve breathing gas supply (bail-out)
  - Protective clothing
  - Tools as required
  - Safety harness
  - Knife
- Adequate supply of oxygen
- Spare parts as required
- Logbook and dive sheets

E. Surface-Supplied Mixed-Gas Diving (HeO_2)

The following are minimum requirements for surface-supplied mixed-gas (HeO_2) diving operations.

1. Minimum Personnel

- 1 - non-diving supervisor
- 2 -divers
- 2 -tenders
- 1 - life support technician

2. Minimum Qualifications of Personnel

a. Supervisor

Must have training or experience in the following areas:

- All qualifications required for air diving supervisor
- Mixed-gas diving procedures and techniques
- Proper gas mix selection for various depths
- Gas console operation
- Mixed gas analyzing equipment
- Special emergency procedures related to mixed gas diving

b. Diver

Must have training or experience in the following areas:

- All qualifications required for an air diver
- Mixed-gas diving procedures and techniques
- Operational procedures for gas diving equipment

c. Tender

Must have training or experience in the following are-as:

- Same qualifications as air diver, with a lower level of experience required
- Familiarity with mixed-gas equipment

d. Life Support Technician

Must have training or experience in the following areas:

- Mixed-gas diving procedures and techniques
- Proper gas mix selection for various depths
- Gas console operations
- Mixed-gas analyzing equipment
- Emergency procedures related to mixed gas diving
- Basic knowledge of air diving techniques
- Diving accident treatment procedures

3. Minimum Equipment

- 1 complete set of deep air diving equipment
- 1 gas control console
- 1 gas analyzing instrument
- 1 open bottom bell (Class II) with emergency breathing equipment and hose group (220 fsw or deeper)
- 1 adequate supply of premixed gas or gas mixing equipment
- 2 helium unscramblers
- I mixed gas decompression and treatment tables
- I diving ladder or other safe means of getting divers out of the water

F. Bell Diving

The following are minimum requirements for bell diving operations:

1. Open Diving Bells (Class II)

Open diving bells shall be provided and used whenever pressure dives exceed the following depth / time limits:

- 220 feet or 2 hours in-water decompression

2. Closed Diving Bells (Class I)

a. Procedures

(I) A closed bell will be used below 300 feet.

(2) A minimum of 2 divers shall be used for dives using a closed dry bell.

b. Minimum Personnel

- I non-diving supervisor
- 2 bell divers
- I surface diver
- 1 tender
- 1 life support technician
- additional personnel as required to conduct safe diving operations

c. Minimum Qualifications of Personnel

(1) Supervisor

Must have training and experience in the following areas:

- All qualifications required for air and He02 supervisors
- Bell diving procedures and techniques
- Proper gas mix selection for various depths
- Gas control console operation
- Mixed-gas analyzing equipment
- Special emergency procedures related to bell diving

(2) Diver

Must have training and experience in the following areas:

- All qualifications required for air and HeO_2 diver
- Bell diving procedures and techniques
- Proper gas mix selection for various depths
- Operational procedures for bell diving equipment

(3) Tender

Must have training or experience in the following areas:

- Same qualifications as air diver, with a lower level of experience required
- Familiarity with mixed gas and bell equipment

(4) Life Support Technician

Must have training or experience in the following areas:

- Bell diving procedures and techniques
- Proper mix selection for various depths
- Gas console operations
- Mixed gas analyzing equipment
- Emergency procedures related to bell diving
- Basic knowledge of air and HeO_2 diving techniques
- Diving accident treatment procedures

d. Minimum Equipment

(1) All equipment required for mixed gas diving

(2) Necessary equipment for bell operations (depending on type)

G. Liveboating

The following are minimum requirements for liveboating operations.

1. Depth/Time Limits

The maximum depth /time limits for liveboating operations is 220 feet or 2 hours in-water decompression.

2. Minimum **Personnel**

a. Air Diving (0 - 60 fsw)

- I - supervisor
- 2 -divers
- 2 -tenders

When crew size is eight (8) persons or more, at Least one member of the crew will be a non-diving supervisor.

b. Air Diving (60 - 220 fsw)

- 1 - non-diving supervisor
- 3 -divers
- 2 - tenders

c. Mixed-Gas Diving (any depth)

- 1 - nondiving supervisor
- 3 -divers
- 2 -tenders
- - life support technician

3. **Minimum Qualifications of Personnel**

a. Supervisor

Must be experienced in liveboating and knowledgeable in all facets of the time and depth for the job at hand or dive being conducted.

b. Diver

Shall be familiar with liveboating operations

c. Lead Tender

Shall be experienced in liveboating operations

d. Vessel Captain:

Should be experienced in liveboating operations to the satisfaction of the supervisor

4. Vessel

a. The vessel shall be acceptable to the diving company and the diving supervisor.

b. A "Kill Switch" shall be in the immediate vicinity of the operator of the boat for immediate shut down of the engines.

c. For operations on dynamically positioned vessels see Chapter Six, "Guidelines for The Specification and Operation of Dynamically Positioned Diving Support Vessels".

5. Minimum Equipment

(Additional to Standard Equipment Required for the Desired Diving Mode/Depth)

a. On all liveboating operations, a third diving hose connected to the manifold shall be available for emergency use.

b. On all liveboating jobs, a bail-out bottle shall be worn by the diver.

c. A free floating decompression buoy or equivalent is to be used in liveboating operations whenever in-water decompression is necessary.

d. A means will be used to prevent the diver's hose from becoming entangled in the propellers of the vessel.

e. A secondary breathing gas supply to the manifold for surface supplied diving must be sufficient to support the following:

- The diver while returning to the surface
- The diver during decompression
- The stand-by diver and main diver at the same time

6. Procedures

a. There will be constant and easily understandable communications available between the dive station and wheelhouse at all times.

b. At **no time** will the tender and/or supervisor allow themselves or the boat to get in a position where the dive hose's direction and location is not easily viewed.

c. The propellers of the vessel are to be stopped before the diver exits the water.

d. Liveboating shall not be done:

- In seas that impede the station keeping ability of the vessel
- In other than daylight hours
- During periods of restricted visibility
- Any time existing conditions make liveboating unsafe in the opinion of the boat captain and/or supervisor

e. A stand-by diver will be continuously prepared to enter the water.

f. All liveboating operations shall be tended from the bow and the boat shall be operated from the wheelhouse or flying bridge.

H. Saturation

The following are minimum requirements for saturation diving operations

1. Minimum Personnel

Saturation diving minimum personnel requirements shall be the same as for bell diving. with the additional personnel needed to operate the system safely on a 24-hour basis.

2. Minimum Qualifications of Personnel

a. Supervisor

Must have training or experience in the following areas:

- All qualifications required for air, HeO_2 and bell supervisor
- Saturation diving procedures and techniques
- Gas mixing and proper mix selections for various depths
- Gas control console operation
- Mixed-gas analyzing equipment
- Special emergency procedures related to saturation diving

b. Diver

Must have training or experience in the following areas:

- All qualifications required for air, HeO_2 and bell diver
- Saturation diving procedures and techniques
- Operational procedures for saturation equipment

c. Tender

Must have training or experience in the following areas:

- Same qualifications as air diver, with a lower level of experience required
- Familiarity with mixed-gas and bell equipment

d. Life Support Technician

Must have training or experience in the following areas:

- Saturation diving procedures and techniques
- Gas mixing procedures
- Proper gas mix selection for various depths
- Gas console operations
- Mixed-gas analyzing equipment
- Emergency procedures related to saturation diving
- Basic knowledge of air, HeO_2 and bell diving techniques
- Diving accident treatment procedures

3. Minimum Equipment

- All equipment required for mixed gas diving excluding a Class II bell
- Necessary equipment for bell and saturation diving (will vary depending on type of system)

4. Maximum Allowable Oxygen And Nitrogen Limits

a. Long Duration Oxygen Limits

The maximum continuous oxygen level in a saturation habitat shall not exceed a partial pressure of 0.6 ATA.

b. Partial Pressure of Nitrogen

The partial pressure of nitrogen in the breathing mixture to divers working underwater shall not exceed 6.1 ATA (equivalent to 220 fsw).

VI. Diving with ROVs

Divers and remotely operated vehicles (ROVs) may be working in the water at the same time. The use of an ROV to monitor the diver enhances the safety of manned diving operations. Procedural guidelines must bc established before mutual operations begin. The following items should be discussed by the Diver, Diving Supervisor, ROV Pilot, ROV Supervisor, and Vessel Master before any dual diving/vehicle operations commence.

1. Establish a clear chain of command. All ROV operations must be coordinated through the Diving Supervisor.

2. Set up two way voice communications between the Diving Supervisor, ROV Pilot, (and the Vessel Master, if liveboating or on DP operations). An ROV video monitor should be set up at the diving station. If communications arc lost. the ROV must maintain position. Notify the diver immediately.

3. All ROV movements, i.e., launch, recovery, and movement around the work site. must be cleared through the Diving Supervisor, if a diver is in the water.

4. The ROV must never approach a Diver without warning. Neither should the diver approach. handle or ride a vehicle without first informing topside and receiving permission.

5. The diver should be aware that some ROVs may pose a serious electrical shock hazard.

6. ROV Thrusters should be fitted with guards.

7. If the diver's hose and ROV umbilical become entangled, the ROV must maintain station until the diver can survey the situation.

8. ROV sonar and locating devices may pose a hazard to the diver.

9. A large ROV can injure a diver by collision.

10. The lights of an ROV can temporally blind a diver. Concurrently, the diver's light can blind the ROV's video system.

11. The diver should not use the ROV's tether as a down line.

12. If the ROV pilot cannot determine the position of the ROV due to poor visibility, high currents, or any technical reason, he must inform the Diving Supervisor immediately. A plan of action for this eventuality should be determined before operations commence A suggested procedure is to:

    - Secure all power to the thrusters and allow the vehicle to float clear of thcjob site (lights, video and sonar still powered up)
    - Inform the diver of the situation
    - Establish position and request diver to confirm status and attitude of the ROV
    - Clear the diver and maneuver ROV back to the work site.

VII. Hand-Held Power Tools

The following are minimum requirements for hand-held power tools. Prior to use of any hand-held power tools a Job Hazard Analysis (Page 3-9) shall be performed.

A. Electrical Hazards

1. All hand-held electrical tools, including hand-held electrical equipment inside bells and habitats, shall be de-energized at the surface before being placed into or retrieved from the water.

2. All underwater electrical equipment powered from topside shall be equipped with a ground fault interrupter (GFI), between the power source and the tool.

B. Switches and Controls

1. All hand-held power tools (i.e., hydraulic and pneumatic tools, water blaster guns) shall have a constant pressure switch or control (except for underwater welding and burning equipment).

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

VIII. Welding and Burning

The following are minimum requirements for welding and burning. Prior to performing welding or burning operations a Job Hazard Analysis (Page 3-9) shall be performed.

A. Grounding

Welding machine frames shall be securely grounded.

B. Insulation & Capacity

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

C. Disconnect Switch

Welding electrical circuits shall have a positive disconnect switch. The switch shall remain open except during actual welding or burning.

D. Protective Apparel

Insulated gloves shall be worn by the diver while engaged in underwater welding and burning.

E. Inert Gas Purging

Closed compartments, structures or pipelines which are subjected to the heat of welding or burning shall be flooded, vented or purged with water or an inert gas which will not support combustion prior to welding or burning, except during hot tapping operations.

IX. Explosives

The following are minimum requirements for employing explosives. Prior to the use of explosives a Job Hazard Analysis (Page 3-9) shall be performed.

A. General

Employers must transport, store and use explosives in compliance with 29 CFR 19 10.109, 29 CFR 1926.912, and with the requirements of this section.

Other state and local regulations may apply.

B. Transport and Storage

Single component explosives shall be transported and stored in magazine boxes. Blasting caps will not be stored with explosives.

C. Circuit Tests

Electrical continuity of explosive circuits shall not be tested with divers in the water

D. Area Clearance

Divers shall be out of the water before explosives are detonated

X. Emergency Procedures

The following emergency procedures are offered as minimum guidelines to assist dive companies in developing their own specific detailed emergency procedures. The steps that are listed may not be in order of preference. Each emergency will dictate its own priorities. In general, every emergency will cause the dive to be aborted until the cause has been fully remedied.

A. Loss of Breathing Media

1. Re-establish breathing media supply by:
   - Activate topside secondary breathing media supply , or
   - Diver go on bail-out bottle, or
   - Put breathing media to diver's pneumo hose and have diver insert pneumo hose into helmet/mask.
2. Alert standby diver.
3. Diver goes to bell/stage.
4. If required, send standby diver to diver's assistance.
5. Terminate dive.

B. Loss of Communications

1. Attempt to establish line-pull signals.
2. Put air to diver's pneumo.
3. Alert standby diver.
4. Diver proceeds to downline/bell stage (if bell, attempt to use bell communications).
5. Bring diver to first stop once line-pull signals are established.
6. If required (unable to establish any form of communications with diver), send standby diver to diver's assistance prior to bringing diver to his first stop.
7. Terminate dive.

C. Fouled or Entrapped Diver

1. Avoid panic and ensure diver does not ditch equipment.
2. Diver informs topside.
3. Alert standby diver.
4. Diver determines extent of entrapment.
5. Diver attempts to free himself.
6. If required, send standby diver to diver's assistance.
7. When diver is free, if shaken, or standby diver was required to go to his assistance, terminate dive.

D. Injured Diver in Water

1. Diver informs topside and dive is aborted.
2. Alert standby diver.
3. Diver determines nature and extent of injury.
4. If required, send standby diver down to assist diver, administer first aid, and evaluate injury. Standby diver should remain with diver.
5. Standby diver assists injured diver to surface, following proper decompression procedures, except when severity of injury indicates a greater risk than omitting decompression.
6. Request required medical assistance and emergency evacuation (if required).
7. Monitor breathing. If breathing stops overpressure diver's regulator, if possible.

E. Severance of Diver's Umbilical - Gas Hose Only

1. Rut breathing media to diver's pneumo hose.
2. Diver activates bail-out bottle.
3. Alert standby diver.
4. If required, diver inserts pneumo hose inside helm&mask.
5. Diver returns to bell/stage.
6. Diver activates and uses emergency breathing media on bell/stage.
7. Terminate dive and follow proper decompression proccdurc.

8. If required, send standby diver down with additional bail-out bottle or hose.

F. Severance of Complete Umbilical

1. Diver activates bail-out bottle.
2. Alert standby diver.
3. Diver returns to bell/stage.
4. Diver activates and uses emergency gas on bell/stage.
5. If umbilical severed on deck and the end of the umbilical is still on deck, send standby diver down umbilical with new hose/bail-out bottle. Otherwise, send standby diver down downline or bell stage cable.
6. Terminate dive and follow proper decompression procedure.

G. Fire in Equipment

1. Extinguish fue; secure equipment.
2. Determine damage and effect on diver.
3. If required, terminate dive; commence decompression.
4. Each chamber must have a means of extinguishing a fire in the interior.

H. Equipment Failure - Diver In The Water

1. Evaluate effect on diver.
2. Inform diver of problem and action planned.
3. Alert standby diver.
4. Alert deck crew.
5. Diver informs topside of his readiness.
6. Activate plan, terminate dive.

I. Oxygen Toxicity in Water

1. Supervisor notes signs or Diver reports symptoms to topside.
2. Reduce oxygen partial pressure (switch to air).
3. Continue decompression an regular table without 50/50 nitrox or oxygen in water.

J. Oxygen Toxicity During Treatment

1. Diver reports to topside.
2. Instruct diver to remove oxygen mask for 15 minutes. After all symptoms disappear, then start oxygen again. Do not count time not on oxygen, pick up decompression where oxygen stopped.
3. If oxygen toxicity symptoms occur for the 2nd time, repeat Procedure 2.
4. If oxygen toxicity symptoms occur for the 3rd time, discontinue oxygen and contact the Safety Department.

K. Emergency Evacuation

1. Notify diver of emergency and terminate dive.
2. Decompress diver according to proper decompression procedures. If not possible, follow omitted decompression procedures.
3. Evacuate all unnecessary personnel to safe platform.
4. Contact management and inform them of conditions as soon as possible.

Dive Emergencies such as Bailout, Bends, Ommitted Decompression, Embolism, etc., are addressed in the following section "Guidelines for Treatment of Decompression Incidents".

Additional emergency procedures should be developed as needed, possibly including but not limited to:

- Loss of power supplies
- Loss of SDC (bell)
- Adverse environmental conditions, including but not limited to:
  - Weather
  - Sea State

Chapter Four

EQUIPMENT AND SYSTEMS

Fourth Edition, 1992
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I . Scope

The equipment described in this chapter of the ADC Consensus Standards for Commercial Diving Operations must meet the requirements as contained in 29 CFR 1910 Subpart T -Commercial Diving Operations (OSHA), and/or (asappropriate), 46CFR Ch. 1, SUBCHAPTER V, Part 197, Subpart B – Commercial Diving Operations (USCG). These documents set forth the minimum jurisdictional requirements for equipment and operations.

Equipment must also meet minimum requirements as described in this chapter.

A. General

A widerange and variety of equipment maybe required to support all typesofdivingoperations. Equipment utilized and necessary for the safe conduct of diving operations shall be suitable for the conditions under which it is intended to be used.

Equipment which provides direct life support to the diver shall be of a type familiar to the diver; i.e. hats, masks, helmets, etc.

Due to the life support nature ofdiving, personnel involved in the operation, maintenance and repair of diving systems & equipment shall have appropriate training and experience in the type of equipment in use.

The diving superintendent shall ensure that all diving systems and equipment have been ewmined and tested to the extent neccssaryto determine its condition and suitability for service as required under jurisdictional requiremcnls.

B. Maintenance Records

1. An equipment log shall be established and maintained

2. All equipment shall have a unique identity traceable to the equipment log.

3. Entries made in the equipment log shall describe the nature of the work performed. including the dates of modification, repair or test, the name of the individual performing the work or test. and the particular piece of equipment involved.

4. Individual persons performing maintenance, repair, calibration, test or modification to any diving equipment shall both print and sign their name in the equipment log.

II. Diver's Dress

A. General

Diver's dress shall be suitable for the job intended and consider such factors as biological, radiological, chemical and thermal conditions.

B. Dry Suits

Dry suits shall:

1. Have a means of preventing over inflation which could result in an uncontrolled ascent.
2. Be constructed of material suitable to the environment in which it is to be used.
3. Protect the diver from the environment, whether it be temperature or hazardous material.

C. Hut Water suits

Hot water suits shall:

1. Flow sufficient water to maintain the diver's environment at the desired temperature.
2. Be capable of withstanding an operating temperature of 110 degrees F (44" C.).
3. Have a means to allow the diver to bypass incoming water prior to it entering the suit.

D. Harnesses

Harnesses shall:

1. Be made of material of suitable strength to lift the diver and his equipment from the water.
2. Have a mechanical quick release between the harness and the umbilical.
3. Be constructed and fitted to prevent an unconscious diver from slipping through, or from a strain being placed on mask or hehnet.
4. Not he used as a weight belt.

E. Weight Belts

Weight belts shall:

1. Be of sufficient weight to maintain the diver at working depth.
2. Not be used as an attachment for the diving umbilical.

3. Be equipped with an appropriate release buckle

4. Be attached to the diver in a manner to avoid accidental disengagement.

F. Bailout Systems

Bailout systems shall:

1. Have a cylinder meeting the requirements of Section X. C. of this chapter (Page 4 - 17).

2. Have a regulator on the cylinder capable ofdelivering the proper pressure and flow to the diver's helmet or mask.

3. Have a means of attachment to the hat or mask which prevents accidental disengagement.

III. Helmets and Masks

A. General

Helmets and masks used for surface supplied diving operations shall:

1. Be appropriate for the task intended.

2. Be capable ofventilating at least 4.5 cubic feet per minute (ACFM) of gas when supplied at the pressure recommended by the manufacturer of the equipment at any depth at which they are operated.
NOTE:
   - large volume helmets not equipped with an oral nasal mask require 6.0 ACFM
   - helmets equipped with an oral nasal require 3.2 ACFM *(U.S. Navy Dive Manual* 1993)

3. Be capable 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.

4. Fitted with a two-way audio communications system.

5. Be equipped with a non-return valve in the main gas supply which closes readily and positively.

6. Have check valves with springs not exceeding 3 psi cracking pressure

7. Be made of corrosion resistant materials.

8. Be protected from over-pressurization

9. Be maintained in accordance with manufacturer's specifications, and have all modifications which effect safety or performance documented in the Equipment Log.

B. Heavyweight Diving Helmet

Helmets designated as a heavyweight diving outfit (Heavy Gear) shall:

1. Meet requirements of "A" above
2. Have a helmet group consisting of a helmet, breastplate, and associated valves and connections
3. Be equipped with a quick dump valve to prevent over inflation

C. Lightweight Diving Helmets

Lightweight diving helmets shall:

1. Meet requirements of "A" above.
2. Be fitted to accept a bailout bottle supply.
3. Be fitted *to* allow for positive and ready removal from the diver in all uses.

D. Closed Circuit and Gas Reclaim System Helmets

Closed circuit and gas reclaim helmets shall:

1. Meet general requirements of "C" above.
2. Be fitted to function on open circuit.

E. BIBS (Built In Breathing Systems)

Individual breathing equipment utilized in PVHO built in breathing systems (BIBS) shall:

1. Be suitable for purpose and cleaned for use with oxygen.
2. Be held in place by adjustable straps, hood or other suitable means that frees the diver's hands.
3. Be capable of providing 2.0 acfm at maximum depth .
4. Be equipped *to* allow user to adjust for ease of breathing or constant free *flow.*
5. Be equipped with an exhaust valve.
6. Be equipped to prevent over-pressurization or rapid negative pressure from endangering the user.
7. Be maintained in accordance with manufacturer's specifications.
8. Mask/breathing device should be disinfected prior to each use.

F. Specialized Application Helmets

Helmets and masks used for specialized applications shall:

1. Meet requirements of "**A**" above.
2. Be inspected for deterioration prior to and after extended use in applications where elements ofdestructive and varied environments are *known* to exist (i.e., contaminated water, underwater burning or welding).
3. Be equipped to prevent entry of contaminants to the diver.

IV. Hoses

A. General

Flexible hoses used with diving systems or equipment shall:

1. Have a minimum burst pressure equal to four (4) times the Maximum Allowable Working Pressure (M.A.W.P.).
2. Have a M.A.W.P. and *flow* rating not less than the system in which it is installed or used and be suitable for the service intended.
3. Have connectors with pressure capability equal to or greater than hose on which they are installed.
4. Have fittings of corrosion resistant material that cannot be accidentally disengaged.
5. Be kink resistant or arranged to prevent kinking.
6. Have a suitable temperature rating when used for hot water service.
7. Be subjected to annualvisual examination and pressure test to 1.1 times design workingpressure of the hose assembly for 10 minutes without *loss* ofpressure (when corrected for temperature).
8. Be visually examined and pressure tested after each repair or alteration.

B. Breathing Gas Hoses

Breathing gas hose assemblies shall:

1. Meet requirements of **"A"** above.
2. Be suitable for breathing gas service.

3. Have a maximum allowable working pressure equal to or greater than maximum depth of dive relative to supply source plus 150 psig.

4. Be subjected to an annual hydrotest to 1.5 times design working pressure with a 200 lb. axial bad applied on fittings while test pressure is applied, test for 10 minutes without loss of pressure (when corrected for temperature) or creep of end fittings.

5. Be of suitable design to prevent collapse when used for operation with higher external pressure than internal pressure.

C. Umbilicals

Diver umbilicals and dive hose assemblies shall:

1. Meet the requirements of "A" above.

2. Be marked from the diver/bell end in 10 foot intervals up to 100' and marked in 50 foot intervals thereafter.

3. Be marked with a unique identity and be subjected to a planned maintenance program.

4. Consist of a breathing gas hose, communications cable, a means of determining the divers depth and an included strength member.

5. Have strength members made of material unaffected by immersion in water for extended periods.

6. Have a minimum break strength of the hose assembly, including terminating hardware, of 1000 lbs.

D. Oxygen Hoses

1. Oxygen hoses shall meet the requirements of "A" and "B" above.

2. Hose assemblies used in systems containing greater than 40% oxygen are to be cleaned for oxygen service.

3. Hoses used for oxygen service shall be identified by a consistent color code or tagged ***FOR OXYGEN USE ONLY.***

4. Lubricants used to assemble fittings on hoses for oxygen service shall be compatible with oxygen.

V. Compressor Systems

A. Compressors and Gas Pumps

Compressors, boosters, gas transfer pumps and filters used to provide breathing air/gas for diving shall be designed and manufactured to:

1. Have suitable personnel protection around rotating machinery that meets OSHA standard for rotating machinery (29 CFR 1910.219), as well as applicable jurisdictional requirements,
2. Have the necessary instrumentation to facilitate operations.
3. Be of the proper type, pressure and flow rate, and be suitable for service intended,
4. Have its' air intake arranged to be clear of exhaust fumes and other contaminants.
5. Have piping in accordance with ANSI code B3 1.1.
6. Have flexible hoses in accordance with **Section IV, Hoses,** of this chapter.
7. Have electrical controls, wiring, and drive units meeting the jurisdictional requirements, when so equipped.
8. Not be used to pump or transfer oxygen unless designed for oxygen service.
9. Be cleaned for oxygen service when used with mixturesofgreater than 40% oxygen and equipped with slow opening valves.

B. Recording Of Maintenance And Repairs

1. Entries shall be made in the equipment log for all maintenance and repairs performed on the compressor and gas system.
   NOTE:
   (Entries shall include items like belt or oil changes on the compressor.)
2. Results of air quality tests shall be kept in the equipment maintenance log.
3. Compressors shall have a unique identity incorporating manufacturer, model, serial number, maximum rated outlet pressure, rated flow capacity and safety valve settings.
4. Compressor units shall be subjected to planned maintenance.

C. Volume Tanks

Volume tanks or receivers used on compressor or breathing gas systems shall be in accordance with **Section X, Compressed Gas Equipment,** of this chapter (Page 4 - 16).

D. Filtration

Filters, when installed to prevent contamination, must meet or exceed the flowrate and pressure rating of the compressor or piping system in which they are installed.

E. Testing

Compressors used for breathing gas shall be functionally tested per the following schedule, and shall conform to design specifications and the air quality requirement of part "F" below.

1. Prior to being put into service.
2. Periodically in accordance with manufacturer's recommendations and planned maintenance schedule.
3. During annual inspection.
4. After any repairs which may affect compressor performance.

F. Air Purity Requirements

1. All compressors, transfer pumps or booster pumps used for breathing air service will be subjected to an air quality test every six months. Compressors with a discharge pressure of 500psi or less shall meet the standards of ANSI CGA 7. I - 1989 for Grade D air, as a minimum, and shall contain a maximum of 25ppm of total hydrocarbon content (as methane). Compressors with a discharge pressure which exceeds 500 psig shall meet the requirements of ANSI CGA 7.1-1989 for Grade E air.
2. Tests in accordance with CGA shall be taken at the discharge point which would normally supply the breathing gas system, the divers hose, or cylinder fill point.
3. Documentation of these tests shall be kept on file and available upon request.
4. Compressors used for breathing gas transfer other than atmospheric air, shall be checked every six months to ensure they do not induce contaminants into the gas being processed.

VI. Diver Entry and Egress Systems

A. Diving Ladder and Stage

Diving ladders and stages shall:

1. Be capable of supporting the weight of two divers plus their gear.
2. Be made of corrosion resistant material or be maintained free of corrosion.

3. Be suitable for the purpose intended.

B. Open Bottom Bells (Class II)

Open Bottom Bells shall:

1. Have an upper section that provides an envelope capable of maintaining a bubble of breathing mixture for a diver when standing on the lower section with his body through the open bottom and his head in the bubble.

2. Have lifting equipment capable of returning the occupied open bell to the dive location.

3. Have an umbilical consisting of breathing gas hose, pncumofathometer and communications cable.

4. Be protected against and maintained free from injurious corrosion.

VII. Pressure Vessels for Human Occupancy – Chambers

A. Diving Pressure Vessels

The following are minimum requirements for PVHO's:

1. Equipment shall be built in accordance with United States Coast Guard Regulations, ASME-PVHO-I, and/or a Classing Society Competent in PVHO Diving Systems.

2. Be subjected to and pass:
   - a pneumatic test to M.A.W.P. annually.
   - a hydro test to the code to which it was built every fifth year or after an alteration or repair to the pressure boundary. Test results must be entered in the equipment maintenance log.

3. Have acrylic windows which are designed, manufactured, inspected, tested, maintained, repaired and replaced in accordance with the ANSI ASME/PVHO, Section 2.

4. Be subjected to a planned maintenance system.

B. Decompression Chambers

Decompression chambers shall:

1. Meet requirements of "A" above.

2. Be dual lock and multiplace (except emergency rescue chambers or chambers designed to mate with another PVHO).

3. Have sufficient internal dimensions to accommodate a person lying in a horizontal position with another person attending (except designated diving bells, transfer locks and emergency rescue chambers).

4, Permit ingress and egress of personnel and equipment while the occupants remain pressurized.

5. Have all doors which are fitted with integral locking/ dogging mechanisms, other than shipping dogs, operable from both sides of the door.

6. Have illumination of the interior sufficient to allow operation of any controls and allow for visual observation, diagnosis and/or medical treatment.

7. Have a visual capability that allows the interior to be observed from the exterior.

8. Have a minimum pressure capability of 6 ATA (165 fsw); or the maximum depth of the dive for dives deeper than 10 ATA (300 fsw).

9. Be capable of a minimum pressurization rate of 2 ATA per minute to 60 fsw and at least I ATA per minute thereafter.

10. Be capable of a decompression rate of 1 ATA per minute to 33 fsw.

11. Have a means to maintain an atmosphere below a level of 25% (percent) oxygen by volume.

12. Have a means of maintaining an atmosphere below 2% (percent) surface equivalent carbon dioxide by volume.

13. Have mufflers/silencers on blowdown and exhaust outlets.

14. Have suction guards on exhaust lime openings inside each compartment.

15. Have piping arranged to ensure adequate circulation.

16. Have all installed flexible hoses meet the requirements of Section IV, Hoses, (Page 4 - 7).

17. Have all penetrations clearly marked as to service.

18. Have piping in accordance with ANSI Code B31.1, and/or ASME/PVHO 1990 or Classification Society to which it was built.

19. Have a dedicated pressure gauge indicating depth for each pressurized compartment.
    - have a calibration of each depth gauge within six (6) months.

- be arranged so as to allow comparison with another gauge while in operation.

20. Have a pressure relief device as per ASME/PVHO-1 or the code of construction.

21. Have the relief valve pressure setting tested annually and the test recorded in Equipment Log.

22. Have an installed breathing system with a minimum of one mask per occupant per lock.

23. Have the capabilityto supplybreathingmixtures at the maximum rate required by each occupant doing heavy work (4.5 ACFM).

24. Have a non-return valve on through hull penetrators supplying any built in breathing (BIBS) system.

25. Have a two way voice communication system between the occupants and the operator, also between other occupants in separate compartments of the same PVHO or an attached PVHO. This may be a sound powered phone system.

26. Have a speech unscrambler when used with mixed-gas.

27. Be equipped with a readily available means for extinguishing fire.

28. When fitted, have electrical systems designed for the environment in which they will operate.

C. Diving Bells (Class I)

Submersible decompression chambers/diving bells shall:

1. Meet the requirements of part "A" above.

2. Have sufficient internal dimension to accommodate the intended number of divers and their equipment.

3. Have protection against mechanical damage to valvespenetrators, sealing surfaces, onboard gas, etc.

4. Have viewports to allow occupants to observe their external surroundings, also sufficient to allow obsenation of the interior from the exterior.

5. Have protection against mechanical damage on all viewports.

6. Have all piping penetrations equipped with a shutoff valve on both sides of the pressure boundary.

7. Have all penetrations, valves, gauges and piping clearly marked as to service and operation.

8. Have all installed flexible hoses meet the requirements of **Section IV, Hoses,** (Page 4 - 7).

9. Be equipped with sufficient lighting to allow occupants to distinguish and operate controls at all times.

10. Have an installed oxygen analyzer readable by the occupants.

11. Have a method of analyzing CO_2.

12. Have a means of removing CO_2.

13. Have a means by which occupants may read internal depth pressure and external depth pressure.

14. Have a primary two way radio communication system between the diving supervisor and all divers supported from the bell, including the bell attendant.

15. Have a secondary communication system connected to the operator station

16. Be equipped with an acoustical beacon operating at 37.5 Khz.

17. Have interior electrical systems which are designed for the environment in which they will operate to minimize the risk of fire, electrical shock or galvanic action of the PVHO.

18. Have metal shell electrical penetrators which are tested to a minimum of two (2) times design pressure of the bell.

19. Have a capability of removing an injured diver from the water.

20. Have an identified secondary lift point capable of supporting the submerged weight of the bell.

21. Have a bell heater or other means of maintaining a physiologically suitable temperature during normal operations.

22. When so equipped, have a means of controlling hot water flow to a diver locked out of the bell.

23. Have gas piping arranged so that a venting or flushing of the bell will not adversely affect the breathing gas supply of any divers supported from the bell.

24. Be equipped with one individual breathing device for each occupant capable of providing breathing gas both from a surface supplied source and the onboard emergency gas.

25. Have sufficient onboard gas to allow a diver to remain outside the bell for 30 minutes at the maximum depth rating of the bell, at a breathing rate of 1.5 cu. ft. per minute.

28. Have a gauge indicating the pressure in the onboard emergency gas cylinders, readable by the bell occupants.

27. Have metabolic oxygen onboard to support the number of occupants for a period of 24 hours at a consumption rate of .017 cu. ft. per minute, per occupant.
NOTE:
Mixed gas in sufficient quantity may be substituted.

28. Have an oxygen supply so arranged that oxygen flow into the bell is limited to a controlled rate or volume relative to the bell internal pressure.

29. Have a first aid kit.

30. Have a basic tool kit.

31. Have a water resistant copy of emergency procedures.

32. Have an umbilical that meets the requirements of **Section IV, Hoses, Parts A, B, C & D.,** and provides: breathing gas, pressurization and exhaust, communications and power, hot water, and other required services.

33. When fitted, have ballast release mechanisms that are designed to prevent accidental release.

VIII. Gauges

Gauges utilized with diving equipment or systems shall:

1. Be suitable for purpose intended.
2. Be cleaned for Oxygen when installed in Oxygen systems.
3. When used to indicate a divers depth;
   - Be of appropriate range and graduation.
   - Be graduated in units consistent with the decompression tables to be utilized.
   - Be calibrated to a known standard every six (6) months.
   - Be recalibrated when a discrepancy exists exceeding 2% of full scale.
   - Be marked with a label, tag or sticker indicating date of last calibration and date due, which will not interfere with full scale visibility.
   - Have a tag or label indicating amount of deviation (+ / -) to the calibration standard.
   - Have calibrations documented in the equipment log.

IX. Timekeeping Devices

Devices utilized to monitor a diver's exposure time under pressure shall:

1. Be suitable for purpose and easily readable.
2. Be compared against a known standard every six (6) months.

3. Be marked with a tag or sticker indicating date of last test,

4. Not be used when an error exceeding one quarter (1/4) of one (I) minute in four (4) hours exists.

X. Compressed Gas Equipment

A. Volume Tanks / Air Receivers

Volume tanks used in diving systems shall:

1. Be designed, fabricated, inspected, tested and certified in accordance with American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel* Code Section VIII, Div. I "Unfired Pressure Vessels", and/or other statutory or classification society requirements.

2. Be equipped with a pressure gauge.

3. Be equipped with a check valve on the inlet side.

4. Be equipped with a relief valve as required by code of manufacture.

5, Be equipped with condensate drain valve, located at its lowest point.

6. Be equipped with slow opening valves when used with design pressures exceeding 500 psig.

7. Be cleaned for oxygen service and have slow opening valves when used in systems containing greater than 40% oxygen.

8, Be inspected internally and externally at least annually for damage or corrosion

9. Be pneumatically tested to MAWP annually utilizing the breathing mixture normally used,

10. Be hydrotested to 1.5 MAWP every 5th year or after any repair, modification or alteration to the pressure boundary and stamped with the test date.

11. Have a unique identity with results of all tests being recorded in the Equipment Log,

B. Gas Storage Cylinders And Tubes

High Pressure Gas Cylinders or Tubes Shall:

1. Be manufactured to recognized code or standard.

2. Be equipped with an over pressure relief device.

3. Be visually examined annually for damage or corrosion.

4. Be hydrostatically tested to 1.5 times MAWP or code requirements every five (5) years and stamped with the test date.

5. Be inspected internally and externally at least annually for damage or corrosion, if used underwater.

6. Be labeled as to contents.

7. Be stored in a well ventilated area, protected from over heating and secured from falling.

C. SCUBA and Bailout Bottles

High Pressure Bottles used for SCUBA and Bailout shall:

1. Be manufactured to recognized code or standard.

2. Be equipped with an over pressure relief device.

3. Be inspected internally and externally at least annually for damage or corrosion.

4. Be hydrotested every fifth year to the requirements of the code of manufacture by an authorized test facility and stamped with the date of test.

5. Have a unique identity with results of all tests being recorded in the Equipment Log.

Chapter Five

ACCIDENT REPORTING

Fourth Edition, 1992

I. Accident Recording

A. Reporting

A detailed description of all occupational injuries and illnesses shall be recorded.

B. Retention of Records

Reports and medical records shall be retained for 5 years except where otherwise mandated by law.

II. ADC Safety Statistics Reporting Standards

A. Introduction

The Safety Statistics Reporting Standards provide a uniform reporting scheme for all members. They define and clarify items in the *ADC Incident Data Reporting Form* for reporting accident data requested by our customers.

These definitions are based on OSHA Reporting guidelines, hut are not in complete conformance with OSI IA. Operators want to compare members with other members, not other subcontractors in different industries. Therefore, these consensus safety reporting guidelines are formulated to be clear, concise, and easily understandable. They apply specifically to the offshore diving industry's unique situation.

Diving contractors who are subject to OSHA recordkeeping requirements should use strict OSHA reporting guidelines when recording incidents on the ADC Incident Data Reporting Form.

The *ADC Accident Classification Flow Chart* is used to quickly determine whether an incident is reportable, and if so. what its classification is. The detailed information below explains the reporting scheme in further detail

B. Scope And Application

1. Area Of Coverage

Incident statistics and hours worked are reported for North American operations only. No foreign data is to considered under these guidelines. Furthermore, only statistics for the area over which the person reporting's office has control should be submitted. The criteria for reporting is control and access to information. An office that dispatches divers for an area, has daily counts of men offshore, and accident reports from those employees, will report for that operation. The individual responsible for submitting the data must state on the form what areas are represented. All incidents must be reported for all personnel whose hours are included in the "TOTAL HOURS WORKED" columns.

2. Applicability

The *ADC Incident Reporting Form* reports information in two sets, for Diving Operations and Total Company.

a. Diving Operations

The basic criteria for determining who to include in this division is control. Report incidents and man hours for all personnel under direct control of the diving supervisor in charge. If non diving personnel are accountable and report to the diving supervisor, then count them. If they report to someone else, then do not report them under Diving Operations. It is assumed that all members have an operations board or report showing daily men working for customers on different jobs. This is an easy and uniform way to determine personnel and hours. Records of daily totals can be kept and used to compute hours worked.

b. Total Company

This is a total representing all company divisions, such as ROV, Construction, Marine, Shop, Office, etc. Diving operations totals are included in these figures. Again, all incidents must be reported for all personnel included in the Hours Worked totals.

III. Incident Classification and Definitions

A. Work Related Incident Or Illness

This includes all incidents or illness that occur while the offshore employee is On *Deck, On Shift*, Or *Under Pressure*. It includes shop incidents occurring *On Duty, A/ The Current Job Site*, and relating to *Job Performance*. Do not include incidents relating to recreational activities. travel, or non job related activities such as eating. Also do not record non job related illness such as colds. diseases of a communicable nature, insect stings etc. Marine animal stings. diving related ear infections, contact dermatitis from job related chemicals, etc. **are** counted.

B. Reportable Incident

The basic guideline for this category is to decide whether the incident required treatment by a Licensed Physician. If the incident never results in a medical expense and is not a bend, then it is clearly non reportable. If the employee receives treatment from a licensed physician that could legally have been performed by a nurse or technician, then it is non reportable. If antibiotics or other prescriptions were administered **one** time only, and if the incident meets all other criteria, then it is non reportable. Negative X-rays, eye flushes, and one time only physiotherapy are also non reportable. Stitches, removal of embedded material from cyc or wound, and a second doctor visit other then for purposes of examination and release **are** reportable. Any other circumstances can be determined by referencing the current OSHA **"Recordkeeping Guidelines For Occupational Illness and Injuries"**

C. Hours Worked

For the purposes of these standards, hours shall be calculated according IO the following:

- **Offshore**
  Man-Days *x* 24 hours
- **Shop**
  Man-Days *x* 12 hours
- **Office**
  Man-Days *x* 8 hours (40 hrs./employee/week)

D. Lost Time Accident or Illness (LTA)

This is a work related accident or illness that results in an employee being unable to perform any work whatsoever for 24 hours or more. not counting the day of the incident or the day the employee returns to work. For offshore personnel not working a regularly scheduled work rotation but serving on a call out basis. the accident shall not be considered to be lost time if hc comes onshore with the rest of the crew at the end of the job, or **one** day only before the last day of the job. if ho can return IO work within seventy-two hours. If the employee has regularly Scheduled crew changes, and comes in on his normal crew change day, or one day before, then it shall not be considered lost time, provided he is able to return to work again within seventy-two hours not counting the day of the incident.

E. Restricted Activity Accident or Illness (R/A)

This is a work related accident or illness that results in an employee being unable to perform the full range of activities to which he was assigned for that job. The same time considerations for lost time accidents apply to restricted activity. If the diver is able to work in the shop or on deck in his restricted capacity even though you may not have work for him, then he can be classified as R/A. OSHA specifies that it is the employers decision as to whether the employee is workable.

F. Non Disabling Accident or Illness

This is a **reportable** incident that is not lost time or restricted activity.

G. Bends

1. Pain Only Bends (Type I)

If treatment offshore is successful and all symptoms are resolved, then the bend is Non Reportable. Totals of all Type I bends should be displayed in the TYPE I column of the reporting form, but not included in the total for non disabling incidents for Diving Operations and Total Company.

2. Serious Symptom Bends (Type II)

If all symptoms are resolved on site, and no further **on shore** Hyperbaric treatment is necessary, the incident is classified as Restricted Activity even though the diver must by examined by a doctor. If further on shore hyperbaric treatment occurs, then the incident is to be considered Lost Time.

H. Number of Dives

Leave surface to reach surface is to be considered one dive. Repet-Ups are only one dive. Saturation exposures are to be considered as number of dives equals man days seal to seal.

I. Total Recordable Incidents

This is the sum of all work related Lost Time, Restricted Activity, and Non Disabling incidents.

J. Incident Rates

The incident rate is calculated for Lost Time Accidents and for Total Reportable Incidents. This is OSHA's method of obtaining a ratio of incidents per hours worked. It represents the total number of incidents equated to one hundred employees working forty hours per week for a fifty week year. *The ADC Standard Incident Reporting Form* has four incident rates to be calculated. Lost Time and Total Recordable incident rates are calculated for both the Diving Operation only and the whole company.

The method of calculation is given by the formula:

$$\text{Incident Rate} = \frac{\text{Number Of Incidents} \times 200{,}000}{\text{Hours Worked}}$$

K. Accident Classification Flowchart

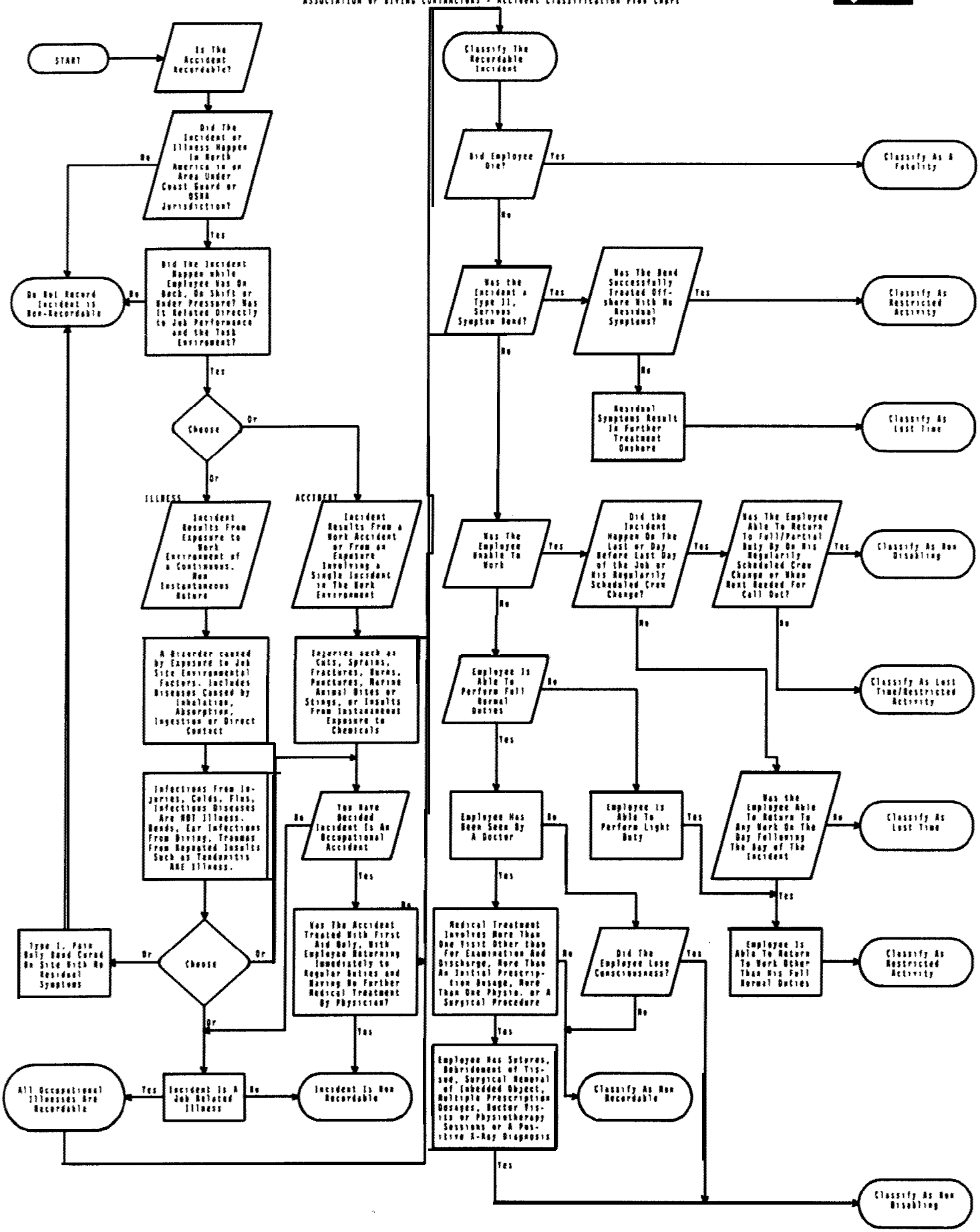
The accompanying Association Of Diving Contractors *Accident Classification Flowchart* assists in the application of the foregoing definitions and should be used in classifying all incidents.

L. ADC Incident Data Reporting Form

The accompanying *ADC Incident Data Reporting Form* shah be used for reporting incident data in response to requests for safety information. Additionally, the Safety, Medical and Education Committee will request all ADC contractors to respond anonymously with their incident data forms once each year. Responses to the survey will be analyzed and reported in "UnderWater Magazine". This will give members opportunity to compare their safety record with industry averages.

The enclosed form may be photocopied and used for a supply, or may be reproduced electronically by personal computer. Disks are available from the offices of the ADC in IBM format for "Lotus 123 "and "Ventura Publisher".

ASSOCIATION OF DIVING CONTRACTORS - Accident Classification Flow Chart



ASSOCIATION OF DIVING CONTRACTORS
INCIDENT DATA REPORTING FORM

PERSON COMPLETING FORM:	
COMPANY	
TITLE/POSITION	
DATE COMPLETED	
PHONE	

INCIDENT RATE = $\frac{\text{NUMBER OF INJURIES/ILLNESSES X 200,000}}{\text{HOURS WORKED}}$

	ON SITE DIVING OPERATIONS WITHIN NORTH AMERICAN WATERS UNDER COAST GUARD/OSHA JURISDICTION										OSHA/COAST GUARD RECORDABLE INCIDENTS TOTAL COMPANY FOR ALL NORTH AMERICAN DIVISIONS						
	FATALITIES	LOST TIME ACCIDENTS	RESTRICTED ACTIVITY	NON DISABLING	TYPE I DCS PAIN ONLY SEE NOTE 1	TYPE I DCS SERIOUS SEE NOTE 2	TOTAL DIVES SEE NOTE 3	INCIDENCE RATES FOR DIVING OPERATIONS		DIVING OP's TOTAL HOUR's WORKED YEAR OR YTD	FATALITIES	LOST TIME ACCIDENTS	RESTRICTED ACTIVITY	NON DISABLING	INCIDENCE RATES COMPANY WIDE		COMPANY WIDE TOTAL HOUR's WORKED YEAR OR YTD
								LOST TIME	TOTAL RECORDABLE						LOST TIME	TOTAL RECORDABLE	
SECTION I INCIDENT HISTORY PAST YEAR 19____																	
SECTION II INCIDENT HISTORY LAST YEAR 19____																	
SECTION III CURRENT EXPERIENCE YTD MONTH																	

DEFINITIONS: LAST YEAR: JANUARY 1, 19____ THRU DECEMBER 31, 19____

PAST YEAR: JANUARY 1, 19____ THRU DECEMBER 31, 19____

RECORDABLE INCIDENT — AN ACCIDENT OR WORK RELATED ILLNESS REQUIRING TREATMENT BY A LICENSED PHYSICIAN AS DEFINED BY THE OSHA RECORDKEEPING GUIDELINES FOR OCCUPATIONAL INJURIES& ILLNESS (September 1986)

LOST TIME INCIDENT — A WORK RELATED ACCIDENT OR ILLNESS THAT RESULTS IN AN EMPLOYEE BEING UNABLE TO PERFORM ANY WORK FOR 24 HOURS OR MORE, NOT COUNTING THE DAY OF THE ACCIDENT OR THE DAY HE RETURNS TO WORK

RESTRICTED ACTIVITY — A WORK RELATED ACCIDENT OR ILLNESS THAT RESULTS IN AN EMPLOYEE BEING UNABLE TO PERFORM THE FULL RANGE OF DUTIES ASSIGNED TO HIM FOR THAT JOB FOR 24 HOURS OR MORE, NOT COUNTING THE DAY OF THE THE INCIDENT OR THE DAY HE RETURNS TO WORK

NOTE 1	NOTE 2	NOTE 3
SYMPTOMS	IF NO	ONE DIVE
RESOLVED	ONSHORE	L/S TO R/S
ON SITE.	TREATMENT	FOR SAT
DO NOT	CLASSIFY AS	DIVES COUNT
INCLUDE	RESTRICTED	NUMBER OF
IN NON	ACTIVITY	MAN DAYS
DISABLING	OTHERWISE	SEAL TO SEAL
COLUMN	LOST TIME	

Chapter Six

GUIDELINES FOR THE SPECIFICATION AND OPERATION OF DYNAMICALLY POSITIONED DIVING SUPPORT VESSELS

Fourth Edition, 1992

I. INTRODUCTION

The purpose of these Guidelines is to incorporate the experience which has been gained in other parts of the world and apply it to the United States. The Association of Diving Contractors Guidelines draw heavily on the experience reflected in the Guidelines issued in 19X.3 by the U J.K. Department of Energy and the Norwegian Petroleum Directorate.

These Guidelines relate to, and are intended to assist in, the design and operation of dynamically positioned diving support vessels. Their purpose is to provide a basis from which designers, suppliers, builders, vessel owners, diving contractors, masters, diving supervisors, and charterers can develop the most suitable equipment and operating procedures for each vessel and to provide a yardstick against which the suitability of DP vessels for diving operations can be assessed.

They represent the current "state-of-the art" in an area of developing technology. They therefore provide practical guidance which may be further updated if this becomes necessary in the light of future developments and additional experience.

Implementation of the Guidelines will vary from vessel to vessel and the characteristics of each vessel will affect its suitability for particular operations. Even in the short term, this may alter in the light of changes in personnel and system components. It is therefore important that the revised Guidelines be used not only by owners in preparing vessels for diving operations, but also by potential charterers in assessing vessels suitability for their particular needs.

Section II clearly states the three main principles which relate to the subject and the following three sections contain guidance on the implementation of these principles.

The general conduct of diving operations from dynamically positioned (DP) vessels should follow the same principles as for other diving operations. In addition, no effort should be spared to establish DP operational reliability and to ensure that, if the vessel does lose station. the effects on the divers are minimized. All those connected with the operation should retain this in mind at all times.

II. PRINCIPLES

A. Introduction

The Guidelines are built around three main and interrelated principles. These are simply stated in this section, The remaining sections contain guidance on their implementation. Though they cover many aspects of DP diving systems and operations, they are not definitive and decisions about features not covered should still be based on these main principles.

B. Single Point Failures

A "catastrophic failure" is defined in these Guidelines as a failure which would, of itself, cause risk to divers. In effect, this means that the failure would cause the vessel to move from its intended position. A fundamental principle of all DP diving vessel design and operation is that no single fault should cause a catastrophic failure. This principle immediately introduces the concept of redundancy. In doing so, it must he stressed that redundancy can be achieved in several ways, (not merely by duplication.) See Section III.

C. Capabilities and Limitations of DP Diving Systems

Any system can operate satisfactorily provided it is not subjected to conditions which are outside its operating capabilities. A fundamental principle of DP diving vessel operation is that the operating requirements of the system are never allowed to exceed the vessel's capabilities in any respect. This principle of itself requires that the vessel's capabilities and limitations are clearly understood and updated with experience and that indications are provided when pre-determined limits are being approached. See Section IV.

D. Personnel Capabilities

Any equipment or system can only work as intended if it is operated correctly. The more complicated the equipment or system, the greater the demands upon personnel operating it, A fundamental principle of DP diving vessel operation is that relevant personnel should be fully capable of performing the tasks entrusted to them. This requires their having the necessary background and experience or being given appropriate training and guidance. See Section V.

III. DP SYSTEM

A. Introduction

Implementation of the first principle defined in II-B involves correct system design. In the context of these Guidelines, the DP system is defined as "all equipment and components involved in retaining the vessel in its required position." The principle states that "no single fault should cause a catastrophic failure." To ensure that a DP system adheres to this principle, a Failure Modes and Effects Analysis of the main components should always be carried out. Where such an analysis indicates that a single fault could lead to a catastrophic failure, the relevant component, sub system, or its operating procedures should be redesigned to avoid or take account of the effects of the single point of failure. In this section some design considerations concerning the main components of DP systems are examined. Recommendations concerning condition monitoring are included based on the premise that to react correctly, system operators must be aware of the failure of any main components.

B. Thrust Units

1. Configuration

Thrust unit installations should be designed to minimize potential interference of wash with other thrust units, sensor systems, the diving system and the divers. and the effect of hull surfaces on thrust unit efficiency within the constraint of ship design.

2. Redundancy

Thrust units and, where appropriate, rudders should be situated to achieve fore and aft, athwartships, and rotational thrust and so configured that the loss of any one thrust unit always leaves sufficient thrust in each direction to ensure that the vessel holds position and heading when operating within its forecast operational capability. (IV-B, Page 6-l 1)

3. Failure Mode

In the event of pitch, azimuth, motor speed control malfunction or when control error becomes unacceptable the function controlled may remain the same as it was at the time of failure, the pitch be automatically set to zero. or the thrust unit automatically stopped and deselected. Under no circumstances should thrust units assume maximum thrust condition on failure.

4. Emergency Stop

Means should be available whereby any thrust unit may be stopped from any DP control without using the DP computer to generate the command. The means provided should be adequately protected against inadvertent operation.

5. Condition Monitoring

The following list indicates the main functions which, where applicable. should be monitored either by permanent remote means or by local means at frequent intervals. Those marked in boldface should also be suitably alarmed. (For those to be displayed at the DP consoles see 111-E-6. Page 6-9)

- Status (on-line/off-line)
- Thruster motor stator winding temperature (high only)
- Thrust unit r.p.m./pitch ordered and indicated (with display or 80% thrust output)
- Oil pressure
- Hydraulic power-pack status
- Azimuth ordered and indicated
- Thrust bearing temperature
- Power supply loss
- Lube oil/hydraulic fluids - pressure/temperature/level
- Response to command signal deviation

  Note: Monitoring of diesel engines where used to drive thrusters by direct drive should be in accordance with 111-C-7, (Page 6-6).

C. Power System

1. Power Factors

Power system design should, so far as possible, provide for generators to be run at power factors which effectively match the characteristics of the load.

2. Redundancy

The power source system, whether individual diesels or central electricity generation plants, should be capable of producing sufficient power to meet the vessel's operational capability subsequent to the failure of any single power unit (IV-B, Page 6-11).

3. Power Management

Arrangements should be provided to ensure that when diving operations are being carried out non-essential loads are shed in reverse order of importance before power consumption reaches maximum available supply. Power supplies to thrusters to maintain station, as well as to the diving system, should be safeguarded. Arrangements should also be made to ensure that sufficient power is always available to enable the vessel to retain position within a predetermined accuracy in prevailing and foreseeable conditions if any one on-line power unit fails. This may mean providing for running up and bringing on-line additional power units as power consumption increases.

4. Essential Services

Essential services such as fuel, oil, ventilation, and generator cooling should also he designed to avoid system failures stemming from failures of critical components, e.g., filters, pumps, power supplies, etc.

5. Operating Limits

Power operating limits should be specified and alarmed for diesel engines, turbines, motors, and generators to avoid engine damage and power factor problems.

6. Distribution Network

Power distribution systems should be such that no single failure can prevent distribution of sufficient power to thrusters to permit the operation of the vessel within its full operational limitations.

7. Condition Monitoring

The following list indicates the main functions which, if applicable, should be monitored either by permanent remote means or by routine local means at frequent intervals.

- Distribution Network
  - Circuit breaker status (auto connect/ disconnect equipment)
  - Bus bar voltage
  - User current levels
  - Load shedding trips (on-line and tripped)

- Back-up power supplies availability (emergency generator or accumulator batteries)

- Diesel Engines
  - RPM
  - Oil pressure/temperature
  - High main bearing temperature indication
  - Auto-start equipment and sequence
  - Bank and individual exhaust temperature
  - Oil level
  - On-line fuel tank level
  - Fuel pressure
  - Fuel rack setting (if applicable)
  - Clutch status (if applicable)
  - Jacket water pressure and temperature
  - Salt water cooling pressure
  - Change air pressure (where applicable)
- Generator/Motors
  - Bearing lube oil flow and temperature
  - Terminal voltage
  - Current
  - Stator winding temperature (high only)
  - Frequency (low)/speed
  - Status (shut down. stand-by, on-line)

D. DP Information Input Systems

1. Position Sensor Redundancy

It is recommended that at least three independent position sensors be available. These need not all work on different principles hut if similar systems are to he considered as independent, they should not be subject to common mode failures (i.e., no single factor should affect more than one system). Whenever DP diving operations are being carried out, at least two independent sensors should be deployed. connected to the DP computer(s), and in use. It is recommended that the third sensor, if not on-line. should be ready for immediate use as a back up. 'lb aid the correct use of sensors in particular circumstances. manufacturers must provide information about the performance and operational limitations of any position reference sensors supplied for use by DP diving support vessels.

2. Vertical Reference Units/Systems

Two VRUs/VRSs should be operating whenever DP diving operations are being carried out and position reference sensors requiring their input are in use. At least one of them should be on-line.

3. Wind Sensors

Care should be taken in siting wind sensors to minimize the effect of turbulence from superstructures. The effect of helicopter down-draft, though normally limited, should be borne in mind. Two wind sensors should be installed in physically separated positions to fake account of failures and false readings resulting from external factors. In some circumstances where interference is unavoidable, the inaccuracies caused by switching off wind sensors may be less than those caused by their false information.

4. Heading Reference Sensors

Two independent heading reference sensors (e.g., gyrocompass) should be running with either both on-line or one on-line and one available as immediate back-up during DP diving operations. Automatic or manual selection of the on-line compass may be provided.

5. Reliability

Sensors should be designed and proven for continuous reliability in the exposed positions in which they operate.

6. Condition Monitoring

Monitoring of DP information input systems should include:

- Facilities for regular full function checks
- Alarms for transducer or circuitry failures
- Detection of data deviation or corruption
- Alarm for power supply loss

7. Position Data Processing

Data from all position sensors should be automatically processed (not manually selected):

- To reject spurious data
- To stabilize output in the event of failure
- To select preferred data
- To alarm if system develops bad geometry or signal loss occurs
- To permit a smooth change-over between systems
- To monitor the sensor status

E. Computer/Control System

1. Purpose

The primary purpose of the DP control system computer is to calculate and order the necessary thrust unit operations required to maintain a vessel in its chosen position. Though it is possible to use the computer for many ancillary functions (e.g., data processing and presentation, power management, etc.), care should be taken to ensure that these cannot prejudice its proper operation in its primary role.

2. Control System Redundancy

There should be at least one hack-up method of controlling the vessel's thrust units in order to retain position in the event of a failure ofthc on-line control system. A second automatic control system can best fulfill this role. If a second automatic system is not fitted, then a joystick control system would he an acceptable hack-up provided:

- It affords manual control of fore and aft, athwartships, and rotational thrust with automatic control of heading.
- The joystick control lever is situated in the I DP control area and located in such a position that the operator has a clear view of the vessel and everything in its vicinity.
- The joystick control system and its power supply are independent of the failed automatic control unit. but provision is made to ensure smooth continuity of thrust unit operation on failure of the automatic control unit.
- Data from a gyro-compass are input direct to the joystick control System.
- A simple display of vessel position relative to irs required position is provided independent of the failed unit, but with the means to ensure its correct alignment with the failed unit at the time of failure.
- It is only used to maintain position for short periods of time, e.g., to recover divers in an emergency. It is recommended that the automatic control system(s) embody a joystick facility to assist in maneuvering the vessel onto location.

3. Power supplies

Provision should be made to ensure that power supplies to computer(s)/ controller(s) are safeguarded at all times. This could involve provision of duplicated conversion machinery and a hack-up battery supply. Batteries should have sufficient capacity to maintain the necessary supplies for at least 30 minutes and a warning of batteries not being fully charged Should be provided.

4. Services Redundancy

Where possible, the design should ensure that services are duplicated and are so divided that if local ventilation and cooling fail, or fire or flooding occurs, sufficient services are retained to enable the divers to be recovered safely.

5. DP Console Sitting

The DP console should be so situated that the DP operator can observe DP controls. see outside the vessel, and be aware of deck operations and the vessel's relationship to surface structures, etc.

6. Monitoring Information

Overall monitoring information should be displayed or made available for call-up in a manner which avoids information overload on the DP operator. Data should he displayed in the simplest manner for easy assimilation. The following information should be available to assist in monitoring overall DP performance:

- Thrust unit configuration and r.p.m. or pitch levels ordered and indicated (with display of 80% thrust)
- Consumed on-line power as percentage of total of available (with special indications at 80%)
- Available thrust units on stand-by
- Position sensor status and validity
- DP System status and validity
- Vessel's target and indicated position
- Vessel's target and indicated heading
- Alert level status (manually operated)
- Limited history event recording system.
  This should provide an automatic record of changes in the main parameters concerned with the vessel's performance such as:
  - Wind speed and direction
  - Position and heading errors
  - Position reference sensor availability and use
  - Thrust unit availability and use
  - Power unit availability and use
  - Computer availability and use

F. Communication Systems

1. Internal Voice Communications

Voice communications should be available to ensure the immediate and clear transfer of information between all responsible parties.

As a minimum requirement, direct communications should be available to ensure the immediate and clear transfer of information between all responsible parties.

As a minimum requirement, direct communications should be provided between DP console and dive control; dive control - bell and diver; dive control and life support control; dive control and bell handling control; dive control, DP console, and ship's derrick or crane; DP console and Master's cabin; dive control, DP console, and senior Diving Supervisor's cabin; and DP console and engine (control) room.

All essential voice communications systems should be provided with 100% redundancy where practicable, either through duplication or provision of an alternative system. Terminals should be situated close to the normal operating positions of personnel for whom they are provided. Primary systems should provide clear voice reproduction and should not detract from users ability to perform their main function.

2. DP Alert System

A system of' lights could be provided in the saturation control room, air diving control area, working deck, and, where applicable, the ROV or submersible control position manually activated from and repeated in the DP control room (See IV-E-4, Page 6-14). The lights could be:

- Steady green light to indicate vessel under automatic DP control, normal operational status, and confirming the Alert System is functional.
- Flashing yellow lighl to indicate degraded DP operating alert.
- Flashing red lighl lo indicate DP emergency.

A distinctive alarm should sound in the saturation control room, air diving control area, the Master's cabin, Operations Superintendent's cabin (if applicable) and the Senior Diving Supervisor's cabin in conjunction with the flashing red lighl. Provision of a means of cancelling the audio and flashing functions of' the signals from the receiving positions when they have been noted should he made.

G. Maintenance of Equipment

Proper maintenance of equipment is essential lo its correct performance. Clear instructions about the type and frequency of' maintenance required by all components of DP systems should be compiled by vessel owners with the aid of manufacturers and suppliers. These should be issued Io vessels together with a system lo monitor their correct implementation.

IV. CAPABILITIES AND LIMITATIONS

A. Introduction

The Second principle, defined in II-C, (Page 6-4), involves knowledge of a vessel's capabilities and the operating requirements. An awareness of the special limitations of diving from a DP vessel should be present at all times amongst those concerned with lhc operation. In addition, certain principles should be adopted to minimize the possibility and effects of the risks IO divers due IO uncontrolled vessel movements. Notwithstanding these principles, the authority of appropriate personnel lo order the termination of DP diving operations if they consider them hazardous even when conditions are within the Guideline limits should not be diminished.

B. Vessel's Operational Capability

The maximum continuous operational station-keeping capabilities for DP diving should be forecast for each DP diving support vessel. These should be expressed in terms of direction and magnitude of wind. associated wave drift force, and current combinations. They should h! defined as "those environmental conditions in which the vessel could maintain chosen position and heading to a satisfactory confidence level with any single thrust or power unit failed and with power available for the foreseeable diving requirements and the vessel's essential services." Capability plots or envelopes of these maximum tolerable environmental forces and their relative heading should be produced lo

assist in defining this information. (Possible form is included in Appendix A.) These should include a statement of the position and heading tolerances and the corresponding confidence levels associated with the capability plots. It should be clearly appreciated that they are only a guide to a vessel's position keeping capabilities and an indication of those capabilities under certain conditions.

Capability plots should be based initially on vessel design information, but should be modified in the light of practical experience. Care should be taken that such modifications are properly reviewed and authorized by the vessel owner. Detailed explanations of the assumptions made in producing these plots should be provided. For example, the power consumption of the diving system and emergency domestic load, the definition of wind speed and thrust output, the assumed wave drift and current conditions, and details of the means to identify the position keeping tolerance and corresponding confidence levels should be included.

It should be noted that the requirement to hold station and heading within operational limits with any single thrust or power unit failed assumes a "worst case" failure. Therefore, in determining the operational limit "envelope," the chosen "worst case" thrust unit will probably vary depending on the relative direction of environmental forces. This should be taken into account.

When determining the vessel's position holding capability, consideration should also be given to any interactions between thrust units, hull, and relative water movement. To simplify the calculation/presentation task, it is proposed that the current force be based on a one-knot current running in the same direction as the chosen wind and wave forces and that the number of "directions" chosen for these coincident forces may be limited to 30 degree increments.

C. Degraded Operational Capability

The principle of ensuring that no single fault can cause a catastrophic failure allows the vessel to be operated with confidence within its designed operational limitations. If the operational capability is degraded, the operation of the vessel should reflect the new status. There is one principal source of degradation of operational capability, namely loss of redundancy of a subsystem. Warning of such loss is provided by the condition monitoring arrangements referred to in Section III. Reaction to such warning is described in IV-E-4 and IV-E-S, (Page h-13).

D. Positioning Accuracy

The positioning accuracy of a DP vessel is subject to several sources of error which can act cumulatively. A forecast of the position and heading tolerances and the corresponding confidence levels should be included with capability plots (IV-R, Page 6-11) and should be taken into account when planning operations close to other vessels or installations. Excursions around the intended position, even if causing no worse problems, tend to swing the bell in a manner which, if it becomes excessive, may be dangerous. With air diving operations, excessive excursions of the vessel could cause hazard to the diver. Their reduction to the minimum achievable level should be a matter of priority both on setting up on DP and, if necessary, in the course of DP operations.

E. Operating Procedures

The objective of all operations should be to ensure that a vessel operates effectively and safely. To achieve this, using the design principles already stated, carefully prepared operating procedures should be adopted. These should themselves be based on three main principles:

- Systems XC checked on installation and after relevant modification. before starting new charters, and immediately before and periodically during USC.
- Operational capability is matched by operational status.
- The procedures adopted should take account of the limitations of the system.

These principles lead lo several outline operating procedures which are explained below.

1. DP Proving Trials

All the precautions and procedures described herein will he lo no avail if the DP system includes uncorrected faults remaining after its original construction. Before a DP diving vessel undertakes DP diving operations after construction or any relevant modification, it should undergo 9 full series of trials.

These should include testing and tuning in harbour, followed by sea trials, during which the vessel's position keeping system should be thoroughly tested under normal and breakdown conditions, and should culminate in il DP bell dive. II is stressed that Commissionmg of systems, piece hy piece, cannot replace the need for thorough testing of the total system under working conditions. Ii is likely that such trials, if properly Conducted, would take several days. Where possible, they should be performed partly in a situation where accurate monitoring of the vessel's position can be achieved and partly in open water under realistic environmental conditions. The results of these trials should be used lo confirm or refine the vessel's performance capability statements.

As an indication of appropriate DP proving trials, checks of the following could be made:

- In Harbour
  - Correct siting and mounting of all equipment and cabling
  - Correct wiring of all power supplies. data Cabling. and equipment
  - Correct functioning of all equipment (including data input systems, computers. interfacing equipment, thruster units, and power supplies) by electronic and functional testing
  - Effective shielding of all potential sources of electrical interference (including those which may only be used intcnnittcntly, e.g., telex, fax. PC's)
  - Software checks and tuning
  - Correct functioning of all Condition monitoring systems and alarms
- Al Sea
  - Correct functioning Of all data inpul systems
  - Correct functioning of computers and interfacing
  - Correct functioning of power management systems
  - Correct functioning of thrust units including response limes
  - Optimum position-keeping performance by fine tuning of software
  - Insure position keeping accuracy using independent means
  - Correct functioning Of all automatic and manual change-over arrangements and proccdurcs from primary to hack-up systems
  - Correct functioning of offset and heading change control
  - Satisfactory operation of DP system with bell running and then divers in water

- Position keeping performance in rough weather

It is stressed that this list is not definitive, but is included as an indication of the type of testing required.

2. New Charter Assessments

In fulfilling their responsibilities under national regulations, diving contractors and field operators whose operations involve the use of DP diving vessels should, before they permit DP diving operations to be carried out, satisfy themselves about the vessel's suitability for the operations planned. This could involve a thorough assessment of a vessel's DP arrangements in line with these Guidelines including a study of relevant documentation such as Operations Manual, FMEA Report, Capability Plot, and any other form of DP system assessment available together with summaries of the experience of personnel involved with DP operations based on their Operators Logs. It should also include a short sea trial during which the actual capability of the vessel and crew to support DP diving in both primary and breakdown conditions should be assessed. Such trials could, if the vessel is satisfactory, be completed in some 8 to 10 hours.

3. Operating Checks

A program of functional checks designed to test the operation of a DP system including the selection and operation of back-up systems should be performed whenever setting up on DP. For example, these could include but not be limited to, simulation of failures of on-line components such as a DP computer, a position reference sensor, a gyro, a generator, or a thrust unit. They could also include commanding offsets in both direction and heading. In addition to the successful completion of these checks, the vessel should have held station automatically within the defined degree of accuracy until the Master and Senior Diving Supervisor are confident that the system is reliably set-up before diving operations are permitted to start. This may take at least 30 minutes.

Re-positioning of a vessel under DP control would not require a repeat of this check period. It is recommended that some or all of these checks be repeated periodically while on DP, but when diving is not being carried out and position keeping is not crucial. By doing so the continued correct functioning of the system can be checked while the readiness of operators to deal with emergencies is enhanced. Instructions for the performance of these checks should be prepared and written by the vessel owner with the assistance of the DP system manufacturer and could be produced in the form of a checklist in a card or folder for ease of use. A more comprehensive arrangement could be provided by a purpose-built simulator.

4. DP Alerts

When diving on DP, a clear system to indicate and guide responses to operational capability is important. This system should be based on a minimal number of standard operating status levels representing the capability of the DP system to retain the vessel on station within safe limits. It is recommended that these levels should represent the following conditions:

- **Normal Operational Status (Green Light)**
  The vessel can be defined as in "normal operational status" when all the following conditions apply:
  - The vessel is under DP control and the DP system is operating normally with appropriate back-up systems available.

- Thruster outputs and total power consumption (where applicable) do not exceed 80% of maximum thrust and total available power respectively for more than brief and isolated periods.
- Vessel's indicated position and heading is within predetermined limits for all but brief and isolated periods. These limits should be determined for each location.
- No risk of collision exists.

- **Degraded Operational Status (Yellow Alert).**
  The vessel can be defined as being in degraded operational status when any of the following conditions applies:
  - There is a failure in a sub-system leaving the DP system in an operational state (possibly after reconfiguration) but with no suitable back-up available so that an additional fault occurrence could result in DP system breakdown and assumption of Emergency Status.
  - Available power units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing or foreseeable conditions.
  - Available thrust units are reduced to the extent that failure of one more could prevent the vessel holding position or heading in existing and foreseeable conditions.
  - With all available thrust and power units on-line, any thrust unit output exceeds 80% of its maximum thrust or total power consumption exceeds 80% of total available power for more than brief and isolated periods.
  - Vessel's indicated position deviates beyond predetermined limits for more than brief and isolated periods.
  - Risk of collision exists.
  - Weather conditions are judged to be becoming unsuitable for DP diving

- **Emergency Status (Red Alert).**
  A vessel can be defined as in "Emergency Status" if either of the following conditions applies:
  - System failure results in inability to maintain positioning or heading control.
  - Any external condition exists, including imminent collision, which prevents the vessel from maintaining position.

5. Alert Level Responses

The following responses could be made to different alert levels. Visual and audible signals should be manually initiated by the DP Operator.

- **Normal Operational Status (Green Light).**
  Full DP diving operations can be undertaken.

- **Degraded Operational Status (Yellow Alert).**
  The Master and Senior Diving Supervisor should be informed. The Diving Supervisor should be informed. The Diving Supervisor should order the diver(s) to return immediately to the bell and obtain a seal. A decision should be taken by the Senior Diving Supervisor, in conjunction with the Master, in the light of prevailing conditions and any possible mitigating actions available whether to abort the dive or not. Under this condition, air divers should be ordered to return to the surface.

- **Emergency Status (Red Alert).**
  The diver(s) should be ordered immediately to return to the bell and obtain a seal. The Diving Supervisor should order the bell to be recovered as soon as possible after quick consideration of hazards involved in doing so (e.g., fouling of anchor wires, jacket members, etc.). The DP operator should use all means available to maintain the vessel in position until the divers are sealed in the bell and the bell is clear of obstructions. The Senior Diving Supervisor and Master should be verbally informed as soon as possible. Under this condition, air divers should be ordered to return to the surface.

6. Communications

Communications between the dive control position and the DP console should be regular and frequent. Each watchkeeper should inform the other about any change in operational circumstances that occurs or that is planned.

The following fist gives an indication of the type of information which should be passed:

- Dive Control to DP Operator
  - Bell status
  - Diver status
  - Intention to use and use of water jetting equipment
  - Possibility of divers, bell equipment, etc. blanking or moving acoustic reference signals
  - Any situation which could develop into an emergency
- DP Operator to Dive Control
  - Intention to move vessel
  - Any change in operational status
  - Background information on causes of changes in operational status
  - Any forecast or actual significant changes in weather
  - Ship and helicopter movements in the vicinity
  - Intention to handle down-lines of any description including repositioning taut wire weight

The following list indicates the type of information needed hy the DP Operator about activities in the vessel:

- Intention to perform and notification of completion of any electrical or mechanical system maintenance or modification which could directly affect on-line DP equipment or make stand-by equipment unavailable
- Intention to start and stop ancillary air/hydraulic units which may reduce pressure on DP or diving associated equipment
- Intention to start and stop pumping of bilges, discharge of sewage, galley waste. etc.
- Intention to start and stop the USC of radio and radar equipment which may affect the DP system
- Intention to handle equipment which may affect the trim of the vessel
- Imminent arrival or departure of helicopter or vessel alongside

The following list indicates the type of information which should be passed between the DP Operator and the platform:

- Platform to DP Operator
  - Planned movements of vessels and helicopters
  - Planned crane lifts or outside platform work which could interfere with the diving operation. or beacon. or transponder sites
  - Intention to discharge mud, galley waste. etc.
  - Planned blackouts in communications or power and hazardous operations (e.g., well-tests)
  - Weather informalion
  - Other subsea operations
  - Other operational or abandoned acoustic beacons or transponders which may he in the vicinity
- DP Operator to Platform
  - Changes in status of divers
  - Changes in status of DP system
  - Intention to perform tasks involving the operation of any hazardous tools or equipment
  - Intended vessel movements

7. Operation of Position Reference Sensors

The following guidance is given based on experience with DP Diving Vessels:

- Acoustic Systems
  - Care should be exercised in the siting of bottom acoustic transponders or beacons and hull transducers or hydrophones to avoid interference from thruster wash, ship's screws, mechanical noises, discharge of sewage, mud, etc. from ships, or a nearby platform or barge, or gas bubbles from diving systems and other sources of acoustic interference.
  - Care should be exercised in the choice of vessel position during operations to ensure that divers and bell arc clear of bottom transponders or beacons.
  - Care should be exercised in the selection and operation of water jetting and air-lift equipment and other tools which generate acoustic interference.
  - Appropriate operating frequencies should be chosen commensurate with water depth and position of bottom transponders or beacons and other acoustic systems in the vicinity.
  - Operators should be aware that structures on the seabed may sometimes produce a coherent pattern of echoes which could cause the vessel to be moved off station.
  - Acoustic systems are liable in shallow water to suffer from limitations to the distance a vessel may deviate from the intended position while still receiving the necessary acoustic signal.

- Taut Wire Systems
  - Regular inspection and maintenance of the wire should be carried out. It should also be cut back and re-secured to the weight frequently to ensure that wear does not become excessive at either the weight or the sheave.
  - Care should be taken in the choice of its position in the vessel to minimize the mechanical limitations of the system. This is particularly important in higher sea states due to the movement of the vessel. It should also be situated as far as practicable from the moon-pool or other diving position.
  - Care should be taken to ensure that the taut wire does not lift off the bottom or, if it does, that an indication of it having done so is given automatically to the DP operator.
  - Measures should be taken to prevent danger to divers if the taut wire is moved and to avoid interference with the taut wire by divers.
  - The taut wire should be lowered to a position as far as possible from subsea pipelines, flowlines, or cables any of which may move.
  - The mechanical limitations to the angle at which the taut wire can effectively operate introduce a limit to the distance from the intended position to which a vessel may deviate. This is of particular importance in shallow water.
- Short Range Radio Systems
  - Vessel operators should be aware of the possibility of temporary loss of information, e.g., due to blanking by other vessels, helicopters, platform equipment, or occasionally rain squalls and action should be taken to avoid or minimize the effects of this.
  - Remote beacons or transponders mounted on manned production platforms are vulnerable to manual interference. Steps should be taken to ensure that they are not tampered with or "blanked off" and that their power supplies are not interrupted. This could include providing battery back-up, connection to the platform's essential service supplies, and siting them in accessible positions. A warning signal should indicate that the main power supply has been cut and the system is working on batteries. The owner of the platform should be responsible for the security of equipment located on the platform.
  - Where possible, alternative frequencies or codes should be prepared to cover the possibility of interference but should be allocated with care.
  - The vessel's position and resulting reference station geometry should be carefully considered whenever a move is contemplated.
  - Interference from radar can cause temporary signal failure or error.

8. Down-Line Handling and Interference with DP Sensors

The handling of all down-lines from DP ships requires special care in the following respects:

- **Taut Wire Errors**
  Long horizontally slung objects which can pivot when suspended in the water can and have come into contact with taut wires which are providing positioning information. Care should be exercised to avoid this.

- **Snagging of Divers**
  Any down-line can snag a diver. Down-lines should only be handled by people experienced in doing so and under supervision of the Diving Supervisor, if necessary, via the bridge. This is particularly relevant when the vessel is being moved.
- **Moving Acoustic Beacons or Transponders**
  Acoustic devices should only be moved by divers under the supervision of the Diving Supervisor and on the direct authority of the Master who should be continuously advised of their movement.
- **Dawn-lines**
  Down-lines should be made up to include a breaking section to reduce the chances of injury to divers.

9. Uncontrolled Movement

The conduct of diving operations from DP vessels. as opposed lo other types, requires particular attention to the risk to divers due to vcsscl movement. The effect of the vessel moving off station Can cause failure of main lift wires, life-support and/or communication arrangements between the vessel and bell, vessel and diver(s). or belt and diver(s). Operating and emergency procedures should be established to minimize these risks and adequate arrangements should be made for the provision of emergency life support, communications, and relocation devices to allow a successful recovery. The bell or air divers should always be positioned with care and, whenever possible. above the level of potential obstructions. The possibility of releasing the tension on the winch wire umbilical and clump weight wire if the bell is on the bottom to avoid dragging it if position is lost, should be considered. Generally, divers should not enter confined spaces when diving from DP vessels. However, in special circumstances and with due regard to the provision of particular means lo ensure their safety in case of DP failure, such operations may be permitted.

10. Operations Plot and Emergency Plans

A plot displaying the relative positions of the vessel, the belt. air divers, the worksite, and any known obstruction (e.g., platform, other vessels, mooring wires, wellheads, etc.) together with ship's heading and wind direction and speed should be maintained at all times at the DP control position. The DP watch keepers should ensure that this plot is always kept up-to-date and that planned emergency procedures have been approved by the Diving Supervisor to provide for the action to be taken in case of DP or other emergency. These plans should be produced in advance of any diving operations. be reviewed, and modified as appropriate.

11. Vessel Movement Limitations

When the bell is launched or air divers are deployed. DP diving vessels should only be moved with the full knowledge and consent of those concerned (in particular the divers) under very restricted and controlled circumstances, as follows:

- U Jnder automatic DP Control
- Generally the vessel should not be moved while divers arc in the waler. I lowever in special circumstances and with due regard to hazardous obstructions, the Master with the agreement of the Diving Supervisor, should be able to authorize limited vessel movements with the divers in the water directed by the divers. Such movements should not exceed the limitations of the position reference sensors and should be made

at slow speed. I leading changes should not exceed 15 percent. When moving, bell divers should be in the close vicinity of the bell (e.g., on the clump weight).

- Limited movements of the vessel which are greater than those described above should only be made when air divers have been recovered to the vessel and with bell divers inside the bell, and the bell recovered to the vessel or positively clear of any potential hazardous obstructions, including the seabed.
- When moving the vessel on DP, particular consideration should be given to:
  - Where the bell is crosshauled or the vessel's vertical axis of rotation does not coincide with the moonpool, in addition to the limitations established above, heading changes should not exceed an angle which causes a 10 meter movement of' the bell.
  - The possible snagging of down-lines with the bell winch wire and umbilical should never be in a bight when moving as it is liable to snag obstructions.

12. DP Operations in Vicinity irf Platforms, Etc.

Particular care must be exercised when operating on DP in close proximity IO fixed objects such as production platforms, mooring buoys, etc. When DP diving is undertaken in the vicinity of anchor wires and cables, the inaccuracy in the knowledge of their actual position at any particular time and the resulting need to keep the bell and bell wires as far from them as possible should be taken into account.

1 3. Visual Reference Points

When close to fixed structures, their value as a visual reference to provide an early additional indication of DP failure should be considered.

14. DP Operations in Vicinity of Other DP Vessels

When operating on DP close to one another, DP vessels are potentially subject to several forms of mutual interference. These include thruster wash, which may affect both hulls and taut wires, acoustic and radio position reference sensor signals, and intermittent shelter from wind and sea. These factors should be considered when planning such operations and due allowance made for them. This may take the form of assuming less accurate position keeping tolerance than would normally be expected, but could also include co-ordination of choice of position reference sensors and frequencies and careful choice of the relative positions of the vessels.

15. DP Operations in Shallow Water

During shallow water operations, there are indications that the limitations of acoustic and taut-wire reference sensors, in terms of the distance from the intended position at which these sensors cart operate correctly (see IV-E-7, Page 6-17), can introduce an extra hazard above those normally associated with their use in deep water. The need to use a surface reference sensor as one of the sensors in such operations is therefore of particular importance. The effect of the strong tidal streams and currents sometimes associated with shallow water should also be taken into account in relation to the position keeping capabilities of DP vessels.

16. Surface Orientated Diving

The following requirements for surface diving operations arc only in effect when the vessel is operating in the DP mode. "DP Mode" is defined as whenever there is any form of motive power in operation. i.e., thrusters or propellers. The requirements are based on the pretnise that at no time should the length of umbilical from the tending point to the diver allow the diver to come into contact with the nearest thruster or propeller that is in an operating tnodc. Very great care is needed in the planning and execution of shallow and surface orientated diving operations to minimize the effect of thrust units on the divers. The effects of thrust unit wash or suction should be carefully considered and precautions taken lo guard against them particularly when the bell or divers pass the potential wash zone. These precautions could include appropriate computer software to avoid any hazardous effects on the operation of the bell or divers, The use of thrust diagrams when planning dives can also help. Inhibiting or deselecting certain thrusters may be necessary and the resulting reduction in the vessel's operational limitations (IV-B, Page 6- 11) should be taken into account. Divers umbilical lengths and the manner of deploying them (e.g.. over the side. from the bell. etc.) should be so chosen that divers and their umbilical are physically restrained from going to positions where they or their equipment could come into contact with thrust units or be adversely affected by their wash. Furthermore. care should always be taken to prevent umbilical developing a bight, and to respond at once to any indications of a diver being in difficulty such as unusual tension on or at the angle of the umbilical. There is no simple approach to the problem due to the differences encountered in the vessels and worksites.

Surface diving can be performed from a DP vessel in the DP mode whether over the side or through the moonpool. if the following conditions are met:

- All of the 1 U.S.C.G. requirements and limits of 46 CFR 197.432 Surface Supplied Air Diving and 46 CFR 107.434 Surface Supplied Mixed Gas Diving must be complied with.
- Written procedures must be prepared for emergency situations (i.e., changes in alert level status, alarms, loss of communications, moving the vessel, etc.).
- The dive crew must be familiar with the vessel's overall design and operating characteristics (i.e.. position of thrusters, propellers, intakes. obstructions. etc.)
- The dive must be conducted from a Class II bell (Wet Bell)
- Consideration should be given to rending the diver from the wet bell especially in the case of significant obstructions on the seabed or for structural penetrations.
- The diver and standby diver tending must be in direct communications with the Dive Supervisor at all rims.
- The Diver Supervisor must be provided with relevant DP alarms and communications systems to the bridge and/or DP control station.
- The topside tenders must be able to listen to all communications between the divers and the Supervisor and must be able to talk directly to the Supervisor.
- The bell umbilical and/or divers umbilical supplying the wet bell and/or divers with appropriate services must be secured to the main lift wire.
- The excursion umbilical arc sccurcd to the wet bell so that the length of the umbilical from the tending point to the diver work site shall never be greater than the distance from the tending point to the nearest thruster. The umbilical must be appropriately marked.

17. Weather Precautions

Due regard should be paid to any indications of impending weather changes, in particular sudden wind shifts and/or gusts. In winter, sudden changes in direction and increases in strength of wind often occur. The use of onboard meteorological instruments including barometer, barograph, wind sensors (both fixed and portable), and wet and dry thermometer is necessary to ensure that timely action is being taken to reduce the possibility of loss of position. In conditions where wind and waves are from opposite sides of the fore and aft line of a vessel, particular care is required as a wind shift to coincide with wave direction is likely to cause rapid change in resultant force on the vessel. A warning of instability when the weather is from roughly ahead or astern can be obtained from thrust unit movements alternating frequently through 180 degrees using appreciable thrust (say over 40%). A case has occurred of a complete power failure resulting from a DP ship being struck by lightning. All reasonable precautions in accordance with good marine practice should be taken to ensure that forecasts of changing weather conditions are obtained and acted upon. These precautions should include:

- Obtaining regular and frequent weather forecasts for the area of operations and use of facsimile facilities and charts
- Seeking information by radio from other units in the vicinity about prevailing weather conditions in their areas
- Use of experience and a "seaman's eye" in assessing the prevailing conditions and likely trends
- The presentation of environmental information measured by the DP system and any trends in conditions which it can provide (III-E-6, Page 6-9.)

18. Collision Risk

Care should be exercised at all times to ensure that the correct lights and shapes are displayed in accordance with the latest international collision regulations (see Appendix C). By the present rules whereas power driven and sailing vessels are required to keep out of the way of a vessel restricted in its ability to maneuver (e.g., a DP diving vessel), a vessel engaged in fishing when underway is required only "so far as possible" to do so. The Master of a DP diving vessel should give early warning that it is unable to maneuver to any vessel which appears to be on a collision course using visual and sound signals. The potential use, if properly employed, of a simple automatic collision warning system should not be overlooked. In conditions of reduced visibility, decisions about the suitability of conditions for diving should rest with the Master of the vessel.

V. PERSONNEL CAPABILITIES

The third principle, defined in Section II-D, (Page 6-4), concerns the ability of the pcrsonncl onboard to perform the tasks entrusted to them. There should be sufficient pcrsonncl having suitable training and experience IO ensure the safety of the vcsscl and all those on board.

A. Authorities

Nothing in these Guidelines shall supercede the spirit or letter of legislation covering the authorities of Masters of Merchant Vessels, of supervisory staff responsible for diving, project control, and offshore installations. It is however of' fundamental importance that the authorities of all personnel concerned with the management of diving operations conducted from dynamically positioned vessels be thoroughly and clearly defined. The responsibility of defining detailed authorities rests with the main contractor who should interpret without losing the spirit of the main principles. I lowever the sections below . (V-A- 1 to V-A-6). give general guidelines.

1. The Master

The Master of the vcsscl is ultifnatcly rcsponsiblc for the safety of his vessel and all pcrsonncl on board working from her, and has ultimate authority to forbid the start or order the termination of diving and DP operations on grounds of safety to pcrsonncl or the vcsscl.

2. Operations Superintendent

The Operations Superintendent, where present, is responsible for the conduct of all operations carried out from the vessel. As such he has authority to forbid the start or order the termination of diving and DP operations for safety or other reasons. I Ie may not order the start of diving or DP operations.

3. The Senior Diving Supervisor

The Senior Diving Supervisor is a diving supervisor appointed by the effective employer of the divers to be in overall charge of all diving operations from the vcsscl and is responsible for all aspects of' diving safety. I Ie has ultimate authority to permit or forbid the start and order the termination of any diving operations on grounds of diving safety. Other diving supervisors may, as necessary, be appointed by the diving contractor, but should be under the control of the Senior Diving Supervisor. For the purposes of these Guidelines, it is assumed that any additional diving supervisors have been vested with the authority and operational responsibility of the Senior Diving Supervisor when on duty and ifntil relieved.

4. The Client's Representative

The client's Onboard Representative should, in conjunction with the contractor's Senior Onboard Representative, be rcsponsiblc to the client for the proper performance of all work in accordance with the contract. He may request the start of DP or diving operations, and should have the authority lo veto the start, or order the termination of diving or DP operations on any grounds.

5. Project Liaison

In view of the additional safety factors involved in DP operations, it is essential that close liaison be maintained between the various authorities concerned. Some organizations may include additional supervisory roles, but the above four authorities should represent the minimum forum for planning meetings concerning DP supported diving operations.

6. Priorities

Priorities should be clearly established for dealing with a DP emergency. The authorities of the Master and Senior Diving Supervisor are of fundamental importance at such times. They should cooperate closely on these priorities so that there is no room for doubt or dissenion. Priorities should take into account that: @BULLET = The safety of life is the first priority. The Master has ultimate authority to assess and decide on courses of action in this respect. The advice of the Senior Diving Supervisor should be taken into account.

- The safety of property is of lower priority. No effort should be made to safeguard property at the expense of safety to life, but the potential danger to life which some threats to property pose should not be overlooked. The advice of Client's Representative and Offshore Installation Owner should be heeded where possible in respect of the safety of offshore installations and equipment.

7. Manning for DP Diving Operations

The requirements for numbers of qualified DP operators will vary. However every DP vessel engaged in diving operations should meet the following requirements:

- The Master of a DP diving support vessel, when performing DP diving operations, should be appropriately trained to be responsible for operating the DP system without supervision (see V-C, Page 6-25).
- Two watchkeepers should be present in the DP control room whenever DP diving operations are being carried out. One of them should hold an appropriate deck-officer's qualification to be in charge of the navigational watch. One should be responsible for operating the DP system without supervision (see V-C, Page 6-25). The other should have received suitable instruction on the principles and operation of DP systems (Appendix B). The second watchkeeper may leave the DP control room to attend to ship's business.
- An appropriately trained technician (Appendix B) capable of minor fault finding and maintenance of the DP system should be onboard at all times when DP operations are taking place.
- The period of time for which the watchkeeper referred to above continuously operates the DP system should be limited to avoid loss of concentration. It is unlikely that continuous periods of longer than two hours would be satisfactory and in some circumstances this may need to be shortened.
- Engine rooms (or engine control rooms) should be manned at all times when on DP.

B. Training and Experience

The amount of training and experience needed by personnel to perform their functions safely varies. However the following minimum standards are recommended, hut some may need be exceeded iii some cases:

- No person should be responsible for operating the DP system in :I DP diving vessel without supervision while diving operations are in progress, until he has:
  - Received suitable instructions on the principles and operation of DP systems (Appendix B)
  - Attained satisfactory practical cxpcricncc by completing a suitable period of supervised DP watchkeeping offshore during which he has simulated the main sub-system failures including failure of automatic computer control. It is suggested that a suitable period would be at least **200** hours.
  - Satisfactorily completed approximately 50 hours supervised DP watchkeeping on the vessel concerned during which he has simulated the main sub-system failures. To assist the owners to monitor this training, it is recommended lhat all DP operators maintain a personal log of their DP experience.
- The Technician(s) responsible for minor fault finding and maintenance of the DP control system should have satisfactorily completed a suitable training course (Appendix B).

C. Operations Manual and Records

Clear guidance about the opcrntion of each individual DP diving vessel should be contained in an Operations Manual prepared specifically for that vessel. The manual should contain sections on at least the subjects outlined in the following subparagraphs.

1. Vessel's Operational Limitations and Alert Procedures

The limitations and procedures as defined in Section 4 above should be clearly stated.

2. Manning

This section should detail the minimutn manning arrangements for the vessel when operating on DP and during diving operations.

3. Responsibilities, Authorities, and Duties

The duties, responsibilities, and authorities of senior personnel should be described based on the guidance in Section V-A. (Page 6-23).

4. DP Operations

A description of the DP system fitted and guidance on the performance of all DP operations including procedures for:

- Operating checks
- Operations of position reference sensors
- Duration of DP operating periods

- Operations in the vicinity of platforms, etc.
- Standard alert levels (with description of warning signals)
- Precautions with regard to weather
- Measures to prevent collision

5. Diving Operations

An up-to-date description of the diving system(s) and guidance on the conduct of diving operations as they may be affected by the DP vessel itself including procedures for:

- Actions to be taken in case of changes in alert level status
- Operation of divers in free flooding and enclosed spaces
- Precautions to guard against thrust unit wash or suction effect
- Surface support and down-line handling
- Information to be provided to dive control positions
- Preparation and use of emergency plans
- Moving vessel

6. Priorities

Guidance should be given on the priorities to be adopted in case of emergency. These should follow the guidance given in V-A-6, (Page 6-24) above.

7. Communications

Guidance and procedures concerning the transfer of information based on the guidance in IV-E-6, (Page 6-16), modified to suit the particular vessel. This section should also contain a description of the voice communication systems and alarm systems which are available and should define the meaning of commonly used terms particularly where they refer to an emergency situation.

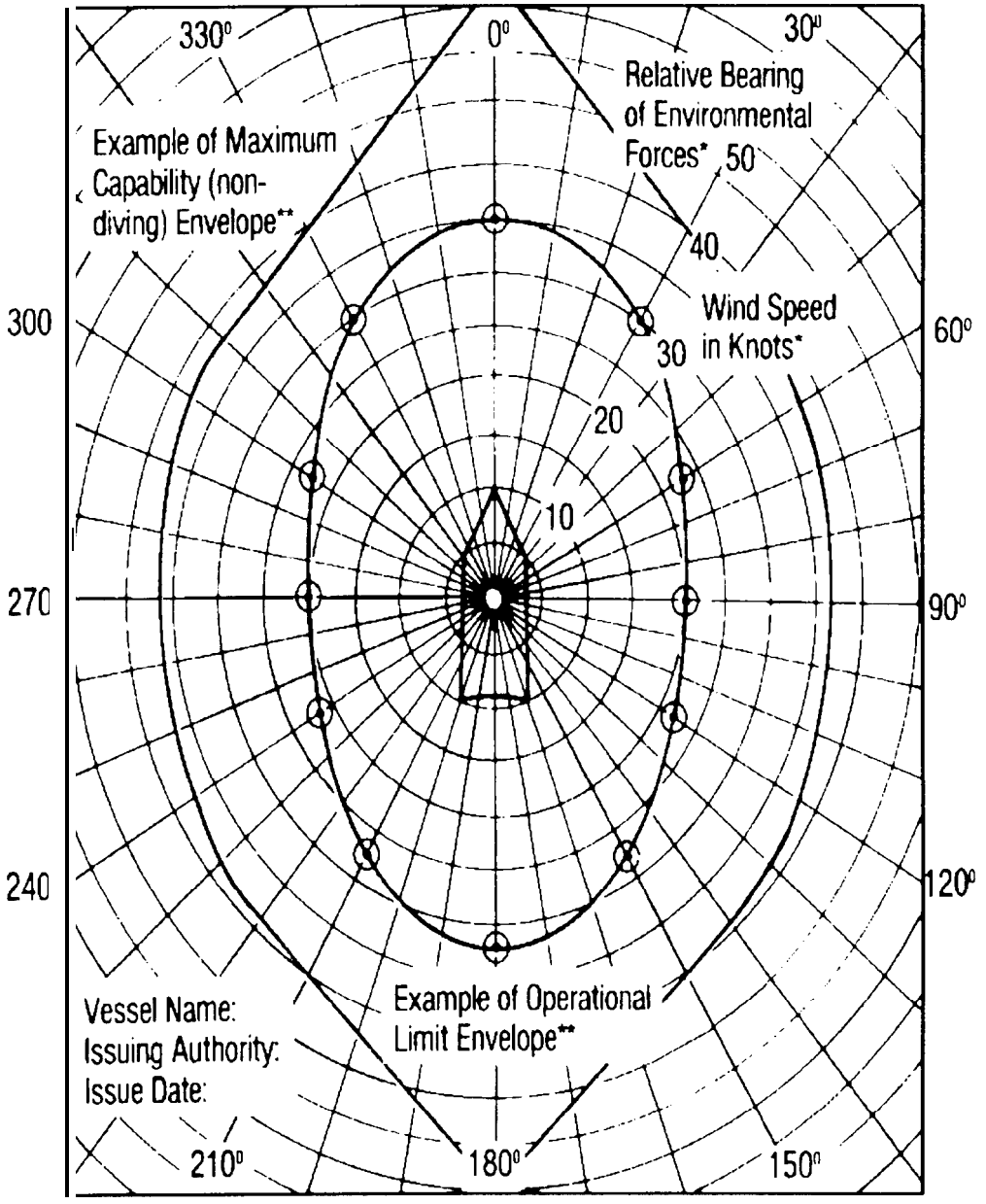
8. Records and Report

Details of all records and reports required by the Master, Senior Diving Supervisor, and others.

D. Information Feedback

Lessons learned in the course of practical DP operations can be of use to others besides those immediately involved. Arrangements for the dissemination of information should be established, so that relevant practical experience and the lessons learned can be made available to others to improve the safety of DP diving operations. This may include dissemination within the vessel, the Company, to designers, manufacturers, and shipyards.

Appendix A
DP Diving Operational Capability Graph



* Total Environmental Force acting on the vessel is based on wind speeds shown with coincident wind-associated wave and knot current forces.

** The capability envelope represents the wind speed and direction (with coincident wave and current forces) within which the vessel can safely hold position.

Appendix B
Suggested Instructions on the Principles and Operation of DP Systems

Paragraphs V-B-2 and V-C of the Guidelines refer to "suitable instruction on the principles and operation of DP systems." The "suitable instruction" referred to is envisaged as being based on the following to "block diagram" level of detail:

- The Principles of DP Operations
  The inter-relationship of positioning information, thrust-vectors and vessel movement. Descriptions of the main components of DP systems.
- DP Information Input Systems
  Description of the purposes of all DP information input systems and the principles on which they work. Their strengths and weaknesses. Factors to be considered in their operation.
- Computer/Control Systems
  The purpose of computer control systems. Brief description of the principle on which they work. Discussion of the manner in which they respond to position error, heading error, wind forces, and how they are designed to control thrust output to take account of the effect of environmental forces on the vessel. Methods used by computers to check the validity of data fed to them, the validity of their own calculations, and the extent to which their command signals are followed. Input of instructions and presentation of information by computer. Computer outputs and interfacing requirements.
- Thrust Units
  Types of thrust unit available with comments on their strengths and weaknesses. Power requirements, control systems. Provision of services - including redundancy needs. The potential effect of thrust units on diving operations. Comparison of pitch/r.p.m. and thrust output. Condition monitoring.
- Power Supplies
  Direct drive, diesel electric, dedicated ring-main, and ship's ring-main. Power distribution, provision of power to essential services, UPS-principles, and general description. Principles of power management. Provision of services to prime movers. Condition monitoring.
- Principles of Redundancy
  Common mode failures, single points of failure, catastrophic failure, failure modes, and effect analyses. Ways to achieve redundancy, duplication of components, provision of alternative back-up systems, and procedural methods.
- Operational Capabilities
  Principles of operational capabilities - relationship between thrust output and effect of environmental forces on vessel. Methods of depicting operational capabilities in graphic and plot form. Principle of operational capabilities reflecting failures of thrust or power units. Recognizing approach to maximum operational capabilities in practical operations.

- DP Operation Simulation
  The operation of a DP computer controller in simulated conditions. Setting up on DP.
  Simulated changes in environmental force. Off-setting position and heading.
  Simulated failures of information input systems, power supplies, thrusters and control systems.

It is envisaged that such instruction is likely to occupy about five working days. In addition to providing initial training for DP Operators, it could also be of value to owners and charterers personnel.

The instruction outlined above could form the first part of the training for technicians referred to in paragraph 5.3 (b). It should be followed by a suitable maintenance course to provide detail of hardware and software facilities available for diagnosis and repair of the relevant DP system. This would also include practical work on die equipment. This extension to the Operators course could occupy a further five to ten working days depending on the complexity of the system concerned and the background of the technician(s).

Appendix C
Display of Diving Lights, Shapes, and Flags

1. Attention is drawn to the International Regulations for Preventing Collisions at Sea - particularly Rules 3(a), 27(b), 27(d), 27(e), 27(g) and 30. Vessels are defined to include every description of water craft including non-displacement craft and sea planes used or capable of being used as a means of transportation on water.

2. The Regulations require that all vessels engaged in dredging or underwater operations, when restricted in ability to maneuver, should exhibit lights and shapes as follows:
   - Three all round lights in a vertical line where they can best be seen. The highest and lowest of these lights should be red and the middle light should be white.
   - Three shapes in a vertical line where they can best be seen. The highest and lowest of these shapes should be balls and the middle one diamond. The shapes should be colored black.

3. If a vessel is engaged in dredging or underwater operations and is making way through the water, then masthead lights, sidelights, and a stern light are required in addition to the lights required in Paragraph 2 above.

4. If a vessel engaged in dredging or underwater operations is at anchor then in addition to the light(s) or shape(s) required for vessels at anchor or aground it should display the lights or shapes required in Paragraph 2 above. If an obstruction exists, then in addition the vessel should exhibit:
   - Two all round red lights or two balls in a vertical line to indicate the side on which the obstruction exists.
   - Two all round green lights or diamonds in a vertical line to indicate the side on which another vessel may pass.

5. If the size of the vessel engaged in diving operations makes it impracticable to exhibit the shapes described above, then a rigid replica of the International Code flag 'A' not less than 1 meter in height should be exhibited and so displayed that it can be seen from all directions.

6. Vessels of less than 7 meters in length are not required to exhibit the diving lights as described above.

7. The interpretation of the regulations makes it mandatory for all vessels to comply with them. The only offshore installations not so affected are permanently fixed platforms which once they have been placed in position are no longer vessels. However, it may be considered prudent for fixed platforms to conform. In addition, Installation Managers of fixed platforms should ensure that all vessels in the vicinity are warned by any means possible that divers are operating from the installation or from any smaller craft close to the installation.

Glossary

Fourth Edition, 1992
Chanae 1.1994

Glossary

ACFM
Actual cubic feet per minute - refers to the actual volume of gas supplied to a diver, bell, etc., at ambient pressure.

Ambient Pressure
The surrounding pressure, at depth (actual or simulated, in a hyperbaric chamber) to which the diver, bell, etc. is subjected.

Appropriate Breathing Mixture
A breathing mixture which, having regard to the system and equipment used in the diving operations, the work undertaken in those operations, and the conditions in which the depth at which they are to be carried out, is suitable in content and temperature and of adequate pressure.

Ascent Times
The time interval between leaving the bottom when the dive is terminated, and reaching the surface. (1 ata.)

Ata.
Atmosphere absolute - total pressure; including atmospheric, to which a diver, bell, etc. is subjected

ATM
Atmosphere - a unit equivalent to 14.7 psi or 760 millimeters of mercury

BailOut
A emergency situation where a diver leaves bottom and comes directly to the surface, exceeding normal controlled ascent rates and missing scheduled decompression water stops.

Bailout Bottle
See Diver-Carried Reserve Breathing Gas

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.

Bends
See decompression sickness

Bibs
Built-In Breathing System - A breathing gas system built into all Deck Chambers and SDC's by which emergency breathing gas or a treatment gas can be supplied to the diver through an oral-nasal mask.

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

Breathing System
Device or apparatus for delivering respirable breathing mixture

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

Cleaned for Oxygen Service

Cleaning of equipment or system to ensure elimination of all hydrocarbons and other potentially dangerous contaminants when system is to be used in oxygen service. See also Oxygen Cleaning.

CNS

Central Nervous System

Compressor

A machine that raises air or other gases to a pressure above one atmosphere.

CPR

Cardio-Pulmonary Resuscitation - a combination of artificial respiration and artificial circulation.

Cylinder

A pressure vessel for the storage of gases.

DDC

Deck Decompression Chamber - DDC (deck decompression chamber)/PVHO (Pressure Vessel for Human Occupancy) - a deck chamber capable of controlled pressurization and depressurization used for decompression, recompression, treatment of diving injuries, or submarine medicine, or as a surface habitat for saturation divers.

Decompression

Releasing from pressure or compression; following a specific decompression table or procedure during ascent; ascending in the water or experiencing decreasing pressure in the chamber.

Decompression Chamber

See Deck Decompression Chamber

Decompression Schedule

A time-depth profile with a specific bottom time and depth, whose application is calculated to reduce the pressure on a diver safely.

DecompressionSickness

A condition with a variety of symptoms which causes the formation of bubbles of gas in the blood or other tissues of the diver during or subsequent to ascent or other pressure reduction.

Decompression Table

A set of decompression schedules computed on a common protocol.

Dive Location

The vessel or other structure from which dives are conducted and supported.

Dive Team

Divers and diver support personnel involved in a diving operation; including the diving supervisor.

Diver Worn Equipment

That equipment required for the safety and well-being of the diver, worn or attached to the diver while underwater.

Diver's Indicator Light

A light attached to a diver for the purpose of indicating the position of the diver when he is on the surface of the water.

Diving Bell

See Submersible Decompression Chamber/SDC

Diving Operations

Any work operation in which some type of diving; or work underwater which involves planned human exposure to increased pressures to perform the job.

Divina Superintendent

The Superintendent, Supervisor, Lead Diver or Diver-in-Charge, have complete responsibility for the safety of the diving operation including the responsibility for the safety and health of all diving personnel.

Dryu i t

A diving suit designed to exclude water from the surface of the body.

D.S.

Dive Supervisor

Exhaust Valve

A valve controlling the venting of gas from a DDC, diver's helmet, suit or buoyancy changing equipment.

Embolism

See gas embolism.

Fizzingal feeling of itchiness or sensation of skin irritation.

FSW

A foot of sea water. A unit of pressure generally defined as 1/33 of a standard atmosphere, which represents the pressure exerted by a foot of sea water having a specific gravity of 1.027, equal to approximately 0.445 pounds per square inch.

Gas Embolism

A condition caused by expanding gases which have been taken into and retained in the lungs while breathing under pressure, being forced into the bloodstream or other tissues during ascent or decompression.

Harness

The combination of straps and fasteners used to attach equipment and his umbilical to the diver.

Helium Unscrambler – Unscrambler – Speech Unscrambler

An electronic device designed to render intelligible the words spoken in a helium hyperbaric environment.

High Pressure Nervous Syndrome (HPNS)

A group of symptoms including uncoordination, tremors of the extremities, disorientation, nausea, dizziness and brief lapses of consciousness occurring at depths of 500 feet or deeper.

Hyperbaric Conditions

Pressure conditions in excess of surface pressure.

Hypothermia

Profound loss of body heat.

Kluae Hose

See pneumofathometer.

Life Support Technician,

Responsible for safe operation of living chambers and reports to Diving Supervisor.

Liveboating

The practice of supporting a diver from a vessel which is underway.

LST
Life Support Technician/Rack Operator

Maximum Working Pressure
The maximum pressure to which a pressure containment device can be exposed under operating conditions (usually the pressure setting of the pressure relief device).

Master
See Person-in-Charge

MAWP
Maximum allowable working pressure. See Maximum Working Pressure.

Mixed Gas Diving
A diving technique *in* which the diver is supplied with a gas mixture other than air for respiration.

Multiplace
A decompression chamber designed to be used by more than *one* person at a *time.*

Niggles al feeling of itchiness or sensation of skin irritation.

No-Decompression Diving
Diving which involves depths and times shallow and short enough so that the ascent can be made to the surface without water stops or subsequent chamber decompression.

Non-Return Valve (Check Valve)
A one-way check valve installed in a gas system to permit gas flow in one direction only. All diving helmets must have a non-retum valve at the gas supply inlet to prevent depressurization of the helmet and thè resultant squeeze, should the gas supply be lost.

Overbottom Pressure
That pressure above ambient, at which a breathing gas supply must be supplied to the helmet/mask so that the diver will have a sufficient supply of gas.

Oxygen Cleaning
Special cleaning process for equipment to be used in oxygen systems which removes all flammables.

Oxygen Compatibility
The ability of a substance to come in contact with high pressure oxygen without ignition.

Oxygen Toxicity
A medical emergency resulting in convulsions and unconsciousness if gone unchecked, caused by breathing a high partial pressure of oxygen under pressure.

Partial Pressure
That portion of the total gas pressure exerted by a particular constituent of the breathing mixture.

Person-in-Charge (Master. Barge Captain, Installation Manager)
In relation to the craft/barge/structure, includes the captain or any other person made responsible by the owner for the vessel of facility, its operation, and the safety, health and we lfare of those on board.

Pneumofathometer – Kluge – Pneumo
A depth measuring device consisting of an open-end hose fixed to the diver, with the surface end connected to a gas supply and pressure gauge (usually marked in fsw). Gauge measures pressure required to discharge water to depth of diver.

PSI

Pounds per Square Inch. An expression of pressure, one atmosphere equals 14.7 psi.

PVHO

Pressure Vessel for Human Occupancy - See deck decompression chamber.

Rack Operator

See Life Support Technician

Relief Valve

A pressure-relieving device that prevents pressure from rising above a preset level.

Saturation Diving

Procedures in accordance with which a diver is continuously subjected to an ambient pressure greater than atmospheric pressure so that his body tissues and blood become saturated with the inert element of the breathing gas. Once the diver's body becomes saturated, he can remain within a specified zone for an unlimited time without incurring additional decompression obligation.

SCUBA

Acronym for Self Contained Breathing Apparatus. Used to describe apparatus in which the inspired air is delivered by demand regulator and exhaled into the surrounding water (open-circuit) and the air supply is carried on the diver's back.

Squeeze

A lack of equalization between parts of the body or between the body and equipment. Extreme cases can cause severe injury or death.

Standby Diver(s)

Another qualified diver at the dive location and immediately available to go to the assistance of the diver in the water.

SDC (Submersible Decompression Chamber) – SCC (Submersible Compression Chamber)

A pressurized bell in which the divers can be transferred to the underwater worksite and return to the surface under pressure.

Surface Supplied Diving

A diving mode in which the diver receives his breathing gas from a supply on the surface.

Treatment Tables

A depth, time and breathing gas profile designed to treat a diver for gas embolism or decompression sickness.

Umbilical

A hose bundle between the dive location and the diver and bell that supplies a lifeline, breathing gas, communications, power and heat as appropriate to the diving mode or conditions.

Unlimited Duration Excursion Tables

Two tables for use with saturation excursion diving which limit upward and downward excursions, and provide a zone in which the diver can move freely without regard to the number of excursions or their duration.

Valve

A device that starts, stops or regulates the flow of fluids.

Volume Tank

A pressure vessel connected to the outlet of a gas supply and used as a gas reservoir.

Weight Belt

A belt worn by a diver to achieve desired buoyancy.

Working Pressure
The pressure to which a pressure containment device is exposed under normal operating conditions.

Work Site
An underwater location where work is performed.

Guidelines for Treatment of Decompression Incidents

The Safety, Medical & Education Committee of the Association of Diving Contractors believes these Therapy Guidelines provide a compilation of the advances in the general "state of the art" for the treatment in the field of decompression incidents. Created from practical experience with the assistance of noted hyperbaric medical expertise and field-proven, they assume a medical perspective of "first, do no harm". These Guidelines also represent a protocol favoring precautionary treatment over insufficient treatment. It is the position of the ADC that no tables, guidelines or other treatment suggestions should be relied upon without an independent assessment and a thorough understanding of the underlying treatment principles. The Association of Diving Contractors accepts no responsibility whatsoever for any incidents, injuries or damages resulting from the use of any information or procedures contained within.

Table of Contents

Introduction

Preface

These Guidelines for on-site Treatment of Decompression Incidents are intended to provide immediate, effective incident management procedures for the dive supervisor. They are not intended to supersede higher medical advice or direction from your company authorities.

The ADC Treatment Guidelines employ only **two** classifications of symptoms:

- Simple
- Serious

It is important to realize that the treatment for a given condition will depend on when it occurs. The Guidelines suggest procedures for **three** different situations:

- **During** a Dive
- After a Dive
- Deterioration During Treatment

Assumptions

These Guidelines are based on several fundamental physiological assumptions derived from consultation with noted hyperbaric medical experts:

- Incidents that occur during a dive before complete decompression involve higher tissue gas loading and therefore require more aggressive treatment.
- Treatment will be the same for embolism **and** serious decompression sickness.
- Serious cases require more aggressive therapy.
- Incidents resulting from a mixed-gas dive require deeper treatment than those manifesting from an air dive.
- Commercial diving's routine practice -- surface decompression using Oxygen with air or mixed-gas bottom mixes and longer bottom times, requires more aggressive therapy (deeper and longer treatment) than provided by traditional protocols.

These Guidelines also assume:

- A chamber with adequate supplies of Oxygen and 50/50 Nitrox is available at the treatment site.
- On mixed-gas diving operations a suitable and sufficient quantity of mixed gas is available so that the full benefit of deeper treatment on table 7A may be achieved.

General Treatment Principles

- Simple symptoms, often painful in nature, may mask more subtle serious symptoms. If there is **any doubt treat as** a serious case.
- A case can never be declared simple without a negative neurological examination.
- The earlier the treatment, the better the result.
- Inadequate treatment may lead to a recurrence.
- The patient must be accompanied by an air breathing tender deeper than 30 feet.

Diagnosis

Classify a Decompression Incident as either Simple or Serious. If in doubt, treat as serious. A simple incident is a single pain-only symptom with a negative neurological examination before re pressurization. All other presentations are classified serious. A single simple symptom without a neuro before treatment begins must be classified as serious.

SIMPLE

Must Be Only

A Single Type I
With

Neurological Examination Negative Before Recompression

Type I SYMPTOMS
Only One of the Following:

– Limb Pain
In or around a joint
Usually shoulder,
Elbow or Knee

– Skin Rash
Itching, marbling, hives
"orange-peel skin"

– "Niggles", "Fizzing"

– Lymphatic
(Considered Very Uncommon)
Swelling of a muscle –
e.g. biceps, triceps, calf
or lymph node –
usually armpit, sometimes
neck or groin —
pain may radiate
down the extremity
Be Careful,
A Neuro Exam is Vital,
if in doubt —
treat as serious

SERIOUS

Any
Of the following presentations:

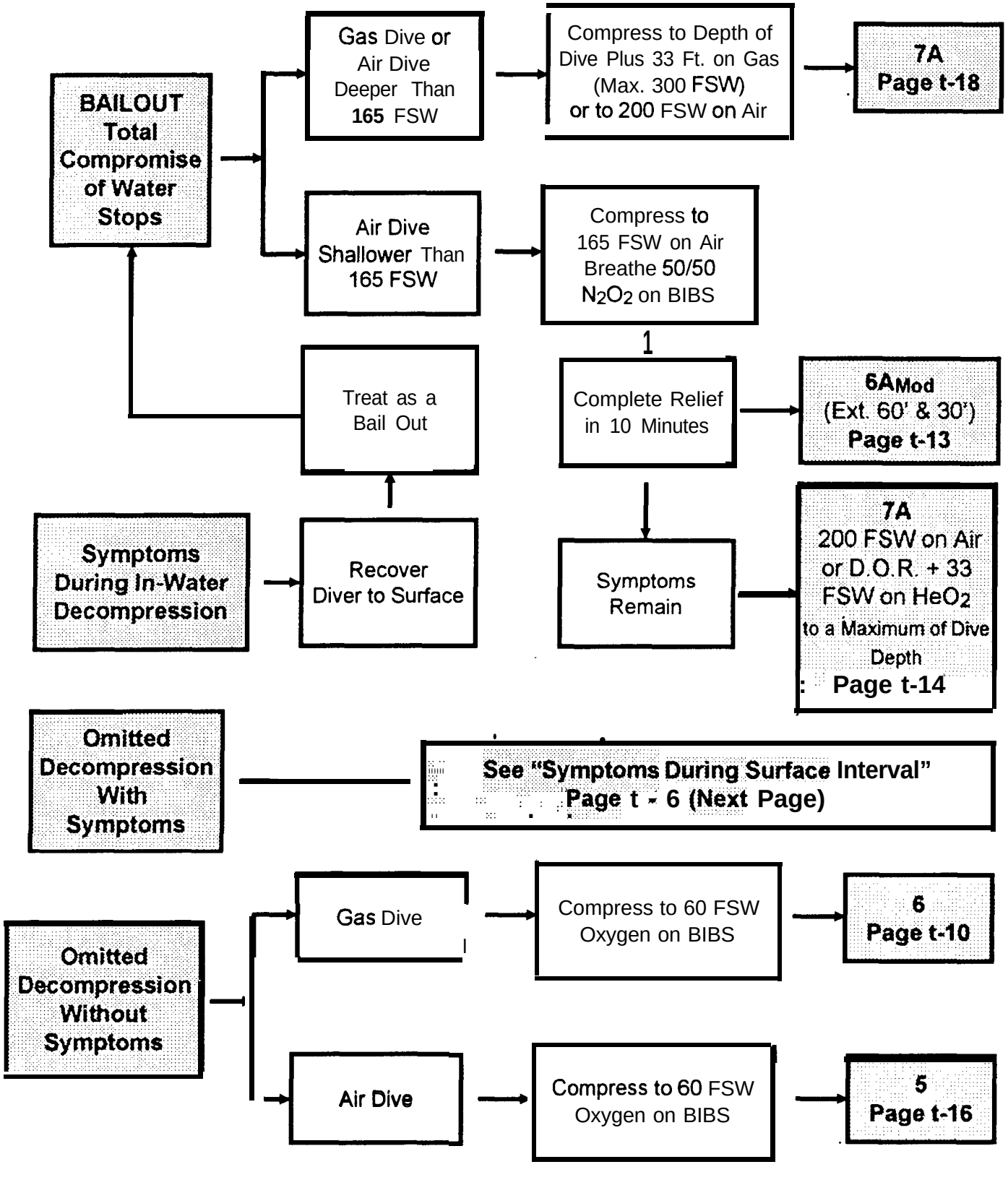
Single Type I without a Neuro
Type II Symptom(s)
Multiple Type I Symptoms
AGE (Arterial Gas Embolism)
Anoxia/Asphyxia/Drowning

Type II SYMPTOMS
The presence of any one of the following symptoms will make an incident serious:

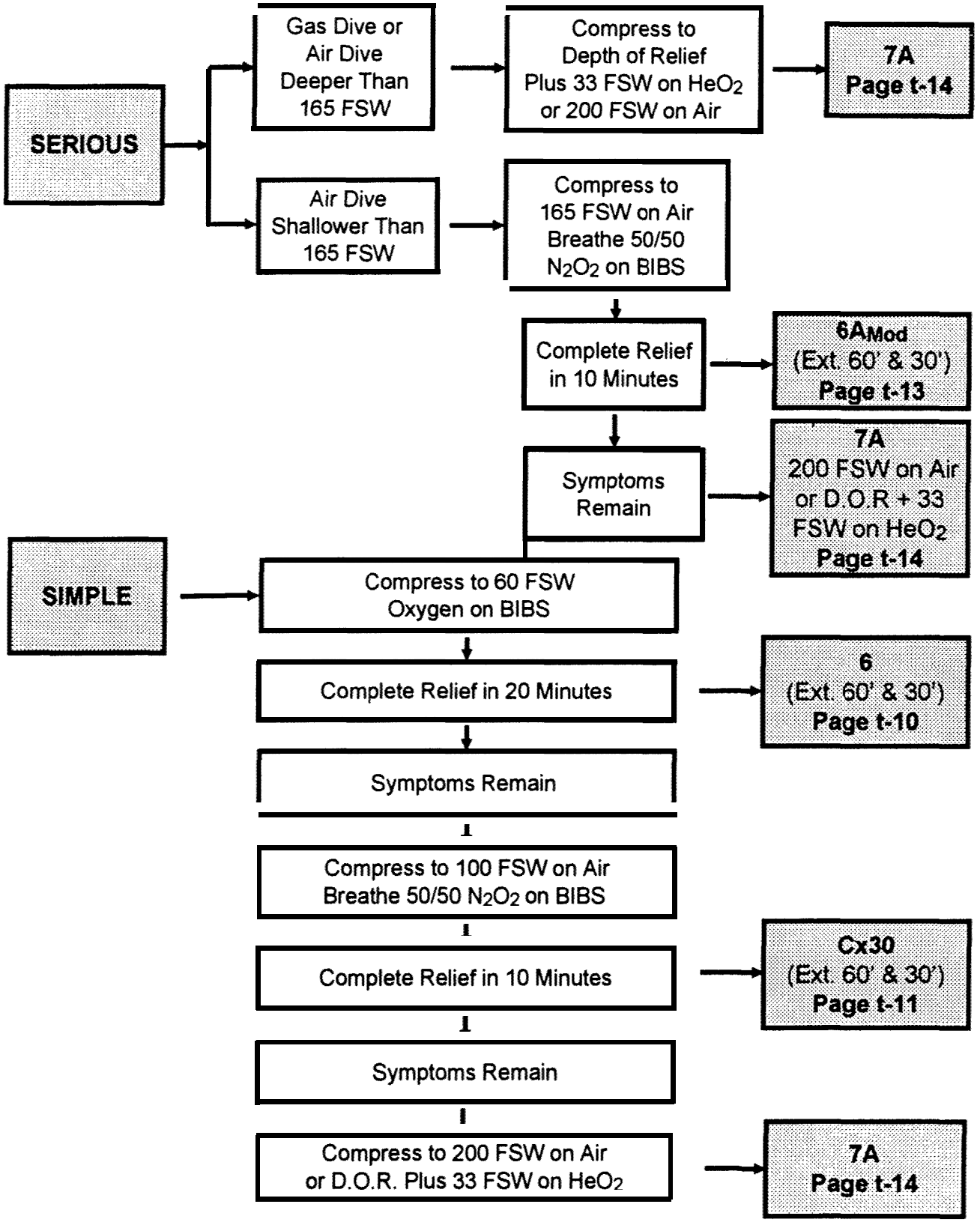
Unconsciousness; Convulsions; Breathing Difficulties (Chokes); Shuck; Paralysis; Loss of Bowel or Bladder Control; Inability to Urinate; A Tight Band of Abdominal (Girdle) Pain; Weakness in the Extremities; Abnormal Fatigue; Loss of Feeling or Sensation; Pins and Needles; Numbness; Confusion; Personality Change; Visual Disturbances; Problems With Balance, Station or Gait; Short Term Memory Loss; Speech Difficulties; Any Type of Motor, Sensory or Mental Impairment

Vestibular/Cochlear Symptoms
Hearing Loss; Loss of Balance; Nausea; Vertigo (Dizziness); Tinnitus (Ringing of the ears)
May be **DCS** — Deep Dives, Gas Changes, Excursion Lock-outs
or Inner Ear **Barotrauma** (Round Window Rupture) — Nut a Bend,
Shallow dives, happens on descent,
nut resolved by recompression therapy

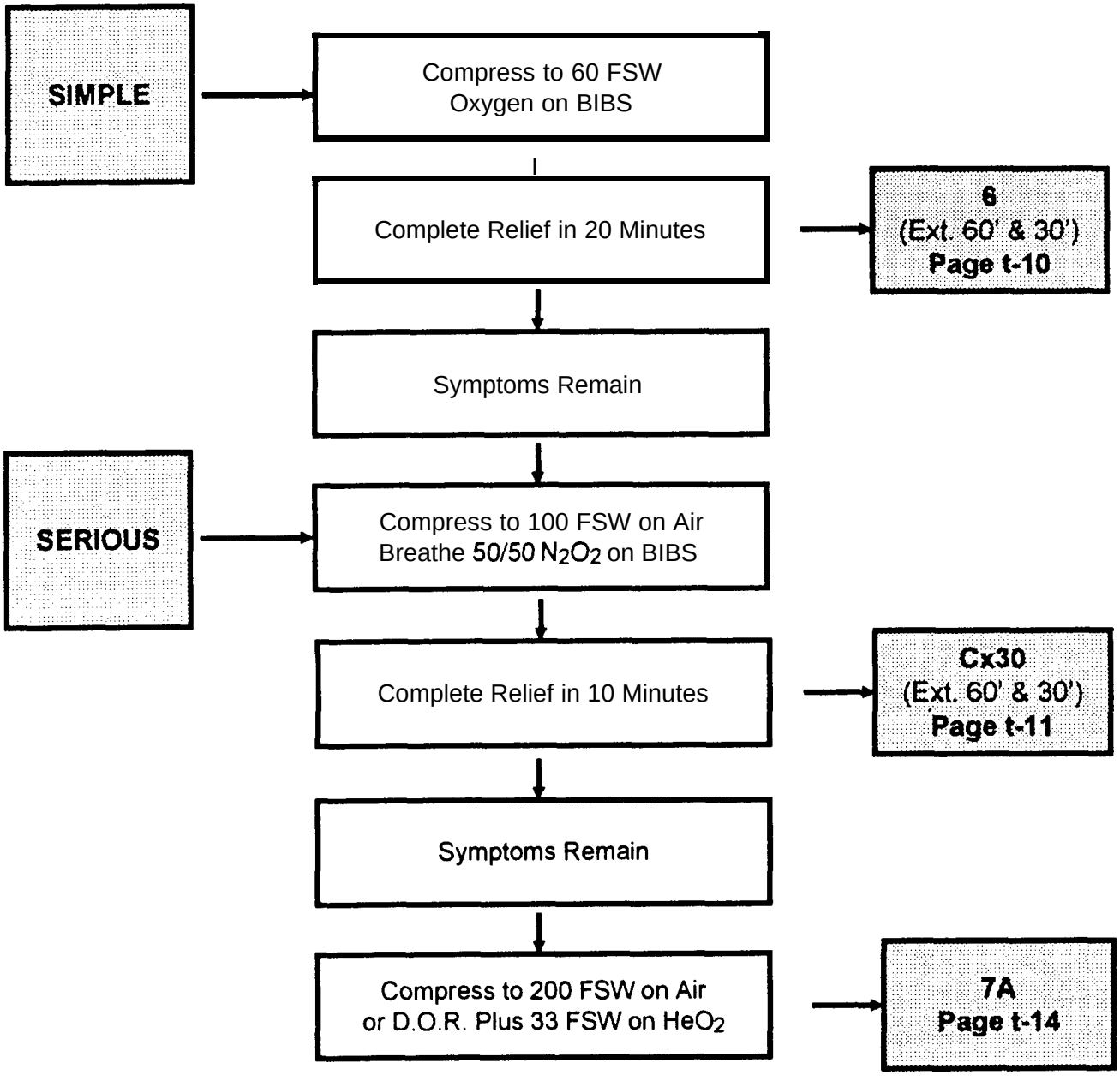
Incident During a Dive



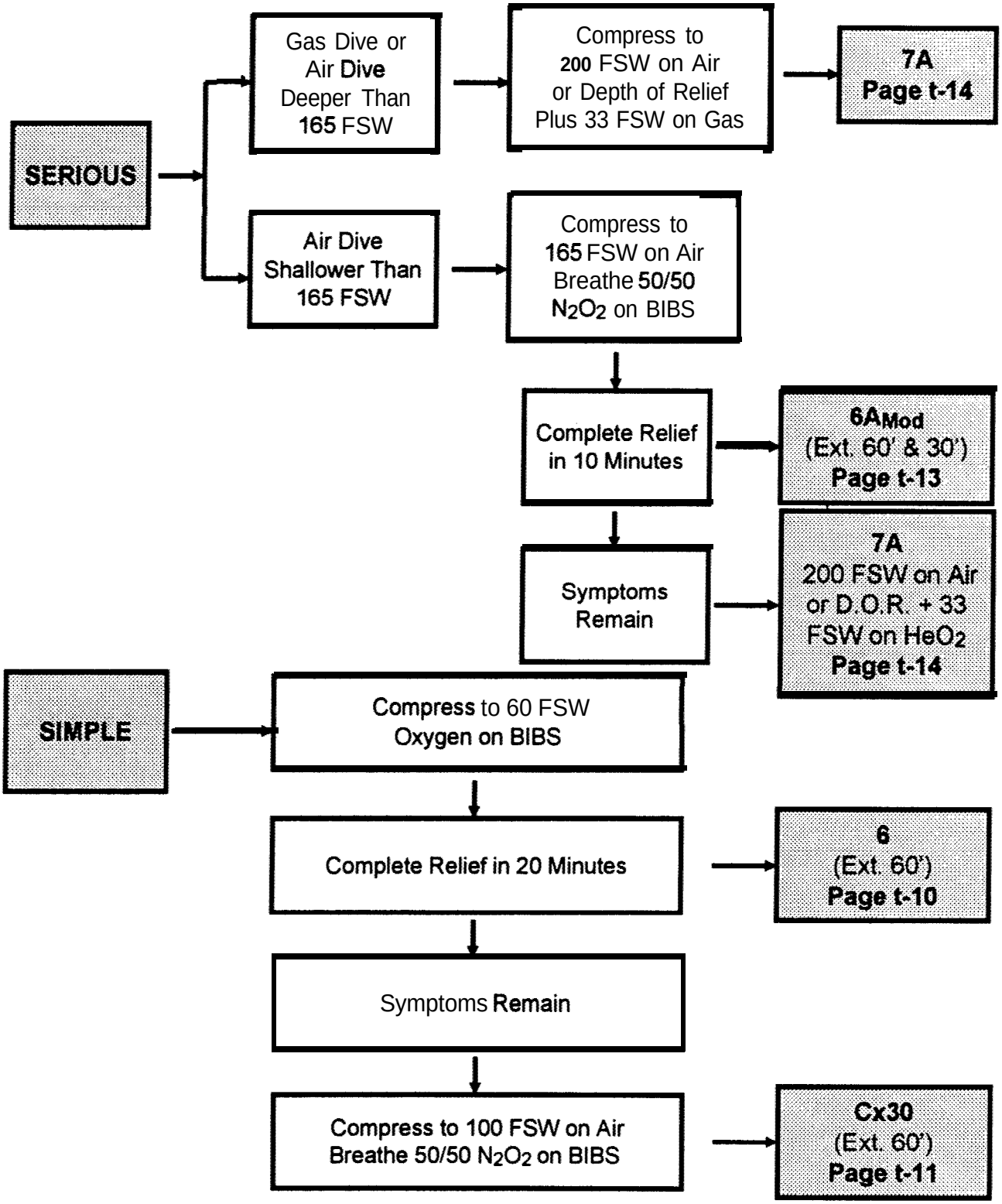
Symptoms During the Surface Interval



Symptoms During Chamber Decompression

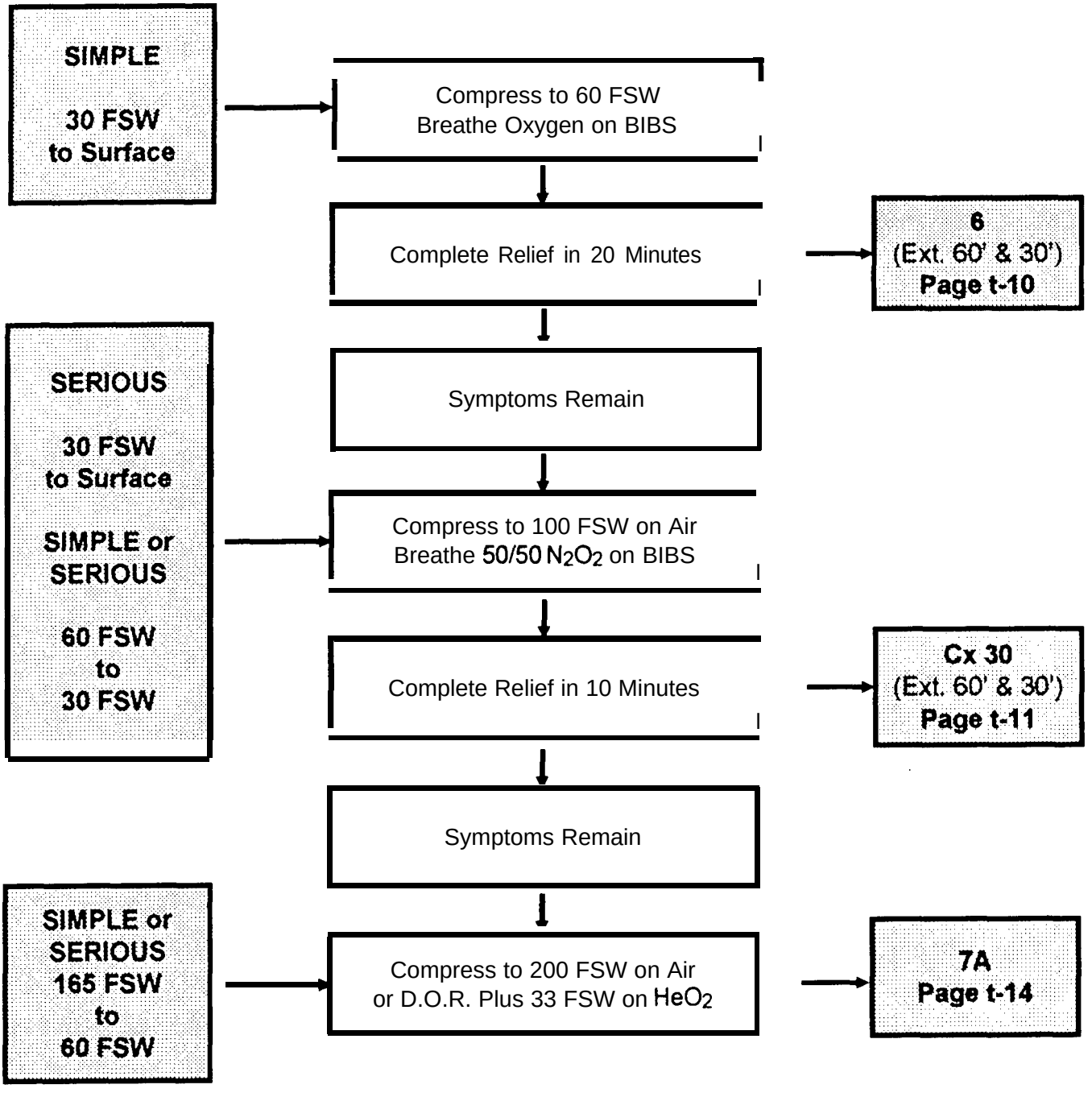


Incident After a Dive



Deterioration During Treatment

Symptoms Worsening at Depth or On Ascent (Recurrence)



U.S. Navy Treatment Table 6

Minimal Treatment at 60 FSW using Oxygen

1. Use Table 6 Fur:
   Asymptomatic table compromise (missed or shortened water stops, exceeded surface interval) during a mixed-gas dive.
   Treatment of simple symptoms with complete relief within 20 minutes on oxygen at 60 feet.
2. Descent Rate — 25 ft/min.
3. Ascent Rate — 1 ft/min. Do not compensate for slower ascent rates. Compensate for faster rates by halting the ascent.
4. Time at 60 feet begins on arrival at 60 feet.
5. If oxygen breathing must be interrupted, allow 15 minutes after the reaction has entirely subsided and resume schedule at point of interruption.
6. Table 6 as used by the ADC Treatment Guidelines can be lengthened by a single extension at 60 feet or 2 extensions, one at 60 feet, and one at 30 feet. An extension at 60 feet is 25 minutes, (20 minutes on oxygen and 5 minutes on air), and an extension at 30 feet is 75 minutes (60 minutes an oxygen and 15 minutes an air).
7. The tender breathes air at 60 feet, and oxygen for 30 minutes during the ascent from 30 feet. If the tender has had a hyperbaric exposure within the past 12 hours and/or the table is extended, the tender breathes oxygen for the last 90 minutes of the table (60 minutes at 30 feet and 30 minutes during the final ascent). If the tender has had more than one hyperbaric exposure within the past 12 hours, and/or if Table 6 has been entered from a 100 foot treatment Table $CX30_{Mod}$ he breathes oxygen during all the oxygen breathing periods at 30 feet and during the ascent.

Depth (feet)	Time (minutes)	Breathing Media	Total Elapsed Time (hrs:min)
60	20	oxygen	0:20
60	5	air	0:25
60	20	oxygen	0:45
60	5	air	0:50
60	20	oxygen	1:10
60	5	air	1:15
60 to 30	30	oxygen	1:45
30	15	air	2:00
30	60	oxygen	3:00
30	15	air	3:15
30	SO	uxygen	4:15
30 to 0	30	oxygen	4:45

Comex Treatment Table CX30Mod

Intermediate Treatment at 100 FSW using 50/50 N_2O_2

1. **Use Table CX30Mod Fur:**
   Serious symptoms occurring during chamber decompression with complete relief within **10** minutes at 100 feet.
   Hard to cure simple symptoms that do not respond after 20 minutes at 60 feet, but are relieved within 10 minutes at 100 feet.
   Serious recurrences during treatment occurring from 30 feet to surface, and any deterioration occurring between 30 and 60 feet during treatment with complete relief within 10 minutes at **100** feet.
2. — as quick as possible, in 2 or 3 minutes
3. Ascent rate between 100 and 80 feet — 1.5 minutes per foot.
4. —
5. Time at 100 feet does not include the compression time.
6. Treatment Mix is 50/50 Nitrox. Heliox is **nut** to be used.
7. On arrival at 60 feet enter Table 6 to complete the treatment. ADC Guidelines will specify whether one or two extensions will be used. Follow the instructions with Table 6 (Page t-10, See #7) to avoid bending the tender.

Depth (feet)	Time (minutes)	Breathing Media	Total Elapsed Time (hrs:min)
100	• 60	50/50 N_2O_2	1 :oo
100 to 80	5	air	1:05
	25	50/50 N_2O_2	1:30
80	5	air	1:35
80	25	50/50 N_2O_2	2:oo
80 to 60	5	air	2:05
	25	50150 N_2O_2	2:30
60	Begin Table 6 with 1 or 2 Extensions as Directed		

* This period may be broken into 25-5 minute cycles

Comex Treatment Table CX30A$_{Mod}$

Intermediate Treatment at 100 FSW using Air

1. **Use Table CX30A$_{Mod}$:**
   In place of CX30$_{Mod}$ when 50/50 Nitrox is unavailable.
   In place of CX30$_{Mod}$ when oxygen intolerance is present.
2. Descent rate — as quick as possible, in 2 or 3 minutes
3. Ascent rate — continuous bleed using the rates shown below.
4. Time at 100 feet does not include the compression time.
5. On arrival at 60 feet enter Table 6 to complete the treatment. Use two extensions, one at 60 feet and one at 30 feet. Follow the instructions with Table 6 (Page t-l 0, See #7) to avoid bending the tender.

Depth (feet)	Time (minutes)	Breathing Media	Total Elapsed Time (hrs:min)
100	*50*	air	1:03
100 to 80	6	air	1:09
80 to 70	so	air	2:09
70 to 60	66	air	3:15
so	Begin Table 6 with 2 Extensions		

U.S. Navy Treatment Table 6A$_{Mod}$

Minimum Treatment for Serious Cases using 50/50 N_2O_2

1. **Use Table 6A$_{Mod}$ For:**
   Treatment of non life-threatening serious cases resulting from an air dive shallower than 165 feet — any symptoms from bailout, serious symptoms during the surface interval, or serious symptoms after the dive, where complete relief occurs within 10 minutes at 165 feet.
2. Descent Rate — as fast as possible
3. Ascent Rate — 1 ft/min. Do not compensate for slower ascent rates. Compensate for faster rates by halting the ascent.
4. Time at 165 feet — includes time from the surface.
5. If oxygen breathing must be interrupted, allow 15 minutes after the reaction has entirely subsided and resume schedule at point of interruption.
6. Table 6A$_{Mod}$ as used by the ADC Treatment Guidelines can be lengthened by a single extension at 60 feet or 2 extensions, one at 60 feet, and one at 30 feet. An extension at 60 feet is 25 minutes, (20 minutes on oxygen and 5 minutes on air), and an extension at 30 feet is 75 minutes (60 minutes on oxygen and 15 minutes on air).
7. The tender breathes air at 60 feet, and oxygen for the last 60 minutes of the table (30 minutes at 30 feet and 30 minutes during the final ascent from 30 feet). If the tender has had a hyperbaric exposure within the past 12 hours and/or the table is extended, the tender breathes oxygen for the last 90 minutes of the table (60 minutes at 30 feet and 30 minutes during the final ascent). If the tender has had more than one hyperbaric exposure within the past 12 hours, he breathes oxygen during all the oxygen breathing periods at 30 feet and during the ascent.

Depth (feet)	Time (minutes)	Breathing Media	Elapsed Time (hrs:min)
165	30	50/50 N_2O_2	0:30
165 to 60	4	50/50 N_2O_2	0:34
60	20	oxygen	0:54
60	5	air	0:59
60	20	oxygen	1:19
60	5	air	1:29
60	20	oxygen	1:44
60	5	air	1:49
60 to 30	30	oxygen	2:19
30	15	air	2:34
30	60	oxygen	3:34
30	15	air	3:49
30	60	oxygen	4:49
30 to 0	30	oxygen	5:19

ECOSystems Treatment Table 7A

Deep Treatment for Serious Cases using HeO_2 and Nitrox

1. **Use Table 7A For:**
   Life threatening symptoms, bailout, or serious symptoms occurring during the surface interval or after a gas or deep air dive. Any symptoms occurring during in-water decompression. Symptoms not relieved within 10 minutes at prescribed treatment depths. Symptoms worsening at depth or on ascent or other situations where extended decompression is necessary.
2. Descent Rate — as fast as patient can tolerate but no less than 25 feet per minute.
3. Ascent — according depth treatment schedule. compensate For faster rates, halt the ascent.
4. If oxygen breathing must be interrupted allow 30 minutes after reaction has entirely subsided and resume schedule at point of interruption.
5. If residual symptoms exist after surfacing, use of Table 5 on subsequent days can be considered. Seek higher medical advice through your company authorities.
6. **Air Treatment**:
   Re compress to 200 feet on air. Stay at 200 feet for 30 minutes then ascend to 165 feet in 1 minute and follow the table to the surface.
   Gas Treatment:
   Re compress to treatment depth as directed by these guidelines. Stay at this depth for 30 minutes, then ascend to 165 feet at 15 feet per hour (4 minutes per foot) and follow table to the surface.

Depth (Feet)	Ascent Rate	Chamber Atmosphere	Breathing Gas	Time (hrs:min)
Final Treatment depth to 165 ft.	Varies (Note 6)	Air or HeO_2	Chamber Atmosphere according to depth	30 min. plus ascent to 165 ft. (Note 6)
165 – 150	15'/hr. (4 min/ft.)	Air	Air	1:00
150 – 100	10'/hr. (6 min/ft.)	Air	Air	5:00
100 – 70	6'/hr. (10 min/ft.)	Air	50/50 N_2O_2 (Note A)	5:00
70 – 60	4'/hr. (15 min/ft.)	Air	Air	2:30
60 – 40	4'/hr. (15 min/ft.)	Air	Air and O_2 (Note B)	5:00
40 – 30	4'/hr. (15 min/ft.)	Air	Air	2:30
30 – 20	2'/hr. (30 min/ft.)	Air	Air and O_2 (Note C)	5:00
20 – 10	2'/hr. (30 min/ft.)	Air	Air	5:00
10 – 2	2'/hr. (30 min/ft.)	Air	Air and O_2 (Note D)	4:00
2 – 0	2'/hr. (30 min/ft.)	Air	Oxygen	1:00

Treatment Table 7A

— Total time from 165 feet to surface = 36 hours.
— Total time from max. treatment depth (300 feet) to air switch at 165 feet = 9.5 hours.

Note A:
Patient breathes 50/50 N_2O_2 for 5 cycles of 30 minutes N_2O_2 and 30 minutes air. If Nitrox is not available, patient breathes Air.
Note B:
Patient breathes Oxygen for 5 cycles of 30 minutes on Oxygen and 30 minutes Air.
Note C:
Patient **and** tender breathe Oxygen for 5 cycles of 30 minutes Oxygen and 30 minutes air.
Note D:
Patient breathes Oxygen for 4 cycles of 30 minutes Oxygen and 30 minutes Air.

Mixed-Gas Therapy

Field experience has shown Table 7A to be extremely successful in the treatment of the most difficult **cases,** when used **initially** and **quickly.** Time is of the essence. No other treatment table gives the on-site supervisor the practical, deep, mixed-gas therapy option necessary to resolve cases involving high tissue gas loading present during incidents occurring from bail-out or deep mixed-gas dives. Table 7A is practical because deep treatment can be achieved without the necessity of a saturation equipped chamber.

Control of Chamber Atmosphere

- For a worst-case situation, chamber environment must be controlled for 9.5 hours. If scrubbing capacity is not available, CO_2 build-up can be controlled by use of overboard du BIBS and/or lung powered scrubbers, and limited chamber flushmg with dive gas. CO_2 evels are normally kept below 0.5% surface equivalent (0.005 ATA $ppCO_2$), but can be allowed to temporarily climb to 3.0% in an emergency situation. Carbon Dioxide levels will rise 1.0% per hour without scrubbers with two divers at rest in a standard chamber.
- Oxygen partial pressure should be maintained as close to 0.5 ATA as possible with the gasses and equipment available until the shift to air is started at 165 feet during ascent. Initial ppO_2 after blowdown must not exceed a maximum of 1.3 ATA.
- Compression gas may be either pure helium or a helium/oxygen mixture. During compression patient and tender must breathe a helium/oxygen mixture by mask appropriate for the depth. Mask breathing must continue at final treatment depth until chamber atmosphere is analyzed and the partial pressure of oxygen is stabilized. This stabilization can be accomplished by flushing or the addition of oxygen as necessary. Occupants can then breathe chamber atmosphere.
- If an incident occurs during a dive that requires the administration of Table 7A, the deck chamber is likely to have the inner lock blown down so as to equalize at 50 feet. Compression will then be by gas over air. The percentage of the blowdown gas will limit the maximum treatment depth if it is too "rich" It is recommended that sufficient quantities of 8% heliox and 50/50 nitrox accompany every chamber on a mixed-gas dive. The following table lists cut-off depths with various blow-down mixes over either one atmosphere of air (chamber on the surface), of over 50 feet of air.

	16%	14%	12%	103-i' 6%	
Surface	224'	257'	300'	300'	300'
50 FSW	159'	181'	254'	300'	300'

U.S. Navy Treatment Table 5

Asymptomatic Table Compromise

1. Use Table 5 For:
   Asymptomatic table compromise (missed or shortened water stops or exceeded surface interval) during an air dive.
   The ADC Treatment Guidelines consider Table 5 a prophylactic decompression for table compromise of an air dive without symptoms. Table 5 is not used to treat actual cases of DCS.
2. Descent Rate — 25 ft/min.
3. Ascent Rate — 1 ft/min. Do not compensate for slower ascent rates. Compensate for faster rates by halting the ascent.
4. Time at 60 feet begins on arrival at 60 feet,
5. If oxygen breathing must be interrupted, allow 15 minutes after the reaction has entirely subsided and resume schedule at point of interruption.
6. If oxygen breathing must be interrupted, switch to Table 6 upon arrival at the 30 foot stop.
7. The tender breathes air at 60 feet, and oxygen for 30 minutes during the ascent from 30 feet to the surface. If the tender has had a hyperbaric exposure within the past 12 hours, he breathes oxygen for the last 60 minutes of the table (30 minutes at 30 feet and 30 minutes during the final ascent). If the tender has had more than one hyperbaric exposure within the past 12 hours he breathes oxygen during all the oxygen breathing periods at 30 feet and during the ascent.

Depth (feet)	Time (minutes)	Breathing Media	Total Elapsed Time (hrs:min)
60	20	oxygen	0:20
60	5	air	0:25
60	20	oxygen	0:45
60 to 30	30	oxygen	1:15
30	5	air	1:20
36	20	oxygen	1:40
36	5	air	1:45
30 to 0	30	oxygen	2:15

federal register

DEPARTMENTOF LABOR

Occupational Safety and Health Administration

■

COMMERCIAL DIVING STANDARDS

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Text of the Regulation

PART 1910--OCCUPATIONAL SAFETY AND HEALTH STANDARDS
Subpart T-Commercial Diving Operations
GENERAL

AUTHORITY: Sec. 6.8.84 Stat. 1593.1596, 1599 (29 U.S.C. 655. 657); Secretary of Labor's Order 8-76 (41 FR 25059); 29 CFR Part 191 I: sec. 41.44 Star. 1444 (33 U.S.C. 941): sec. 107, 83 Stat. 96 (40 U.S.C. 333).

Appendix A--Recommended British Medical Research Council Decompression Sickness Registry Techniques, Skeletal Radiological Investigation for Divers

Subpart T-Commercial Diving Operations

AUTHORITY: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653,655, 657); Sec. 107, Contract Work Hours and S afety Standards Act (Construction Safety Act) (40 U.S.C. 333); Sec. 41, Longshoremen's and Harbor Workers' Compensation Act (33 U.S. C. 941); Secretary of Labor's Order N. 8-76 (41 FR 25059) or 9-83 (48 FR 35736), as applicable; 29 CFR Part 1911.

Source: 42 FR 37668, July 22, 1977, unless otherwise noted.

GENERAL

§ 1910.401 Scope and application. § 1910.401 SCOPE AND APPLICATION.

(a) Scope

(1) This subpart (standard) applies to every place of employment within the water of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands. Wake Island, Johnston Island, the Canal Zone, or with in the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462 43 U.S.C. 133 1), where diving and related support operations are performed.

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

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the node compression limits;

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

(iii) Governed by 45 CFR 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.

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

(A) 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.

(B) 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.

(b) 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:

(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

(2) Upon request from the Area Director, submit such information in writing.

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

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

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

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982]

§ 1910.402 § 1910.402 Definitions.

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

"Acfm": Actual cubic feet per minute.

"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.

"ATA": Atmosphere absolute.

"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.

"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.

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

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

"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.

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

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

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

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

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

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

"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.

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

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

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

"Hyperbaric conditions": Pressure conditions in excess of surface pressure.

"Inwater stage": A suspended underwater plat-

form which supports a diver in the water.
"Liveboating": The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.
"Mixed-gas diving": A diving mode in which the diver is supplied in the water with a breathing gas other than air.
"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.
"Psi(g)": Pounds per square inch (gauge).
"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.
"SCUBA diving": A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.
"Standby diver": A diver at the dive location available to assist a diver in the water.
"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.
"Treatment table": A depth-time and breathing gas profile designed to treat decompression sickness.
"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.
"Volume tank": A pressure vessel connected to the outlet of a compressor and used as an air reservoir.
"Working pressure": The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982]

PERSONNEL REQUIREMENTS

§ 1910.410 Qualifications of dive team.

§ 1910.410 Qualifications of dive team.

(a) General.
(1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.
(2) 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.
(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).
(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.
(b) Assignments.
(1) 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.
(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) 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.
(c) Designated person-in-charge.
(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.

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

General Operations Procedures

§ 1910.420 Safe practices manual.

§ 1910.420 Safe practices manual.

(a) 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.

(b) Contents.

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

(2) 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.

(The information collection requirements contained in paragraph (b) were approved by the Office of Management and Budget under control number 1218-0069) [42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

§ 1910.421 Pre-dive procedures.

(a) General. The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

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

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

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

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

(c) First aid supplies.

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

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

(3) In addition to any other first aid supplies, and 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.

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

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(7) Repetitive dive designation or residual inert gas status of dive team members;

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

(9) Emergency procedures.

(e) Hazardous activities. To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which arc likely to interfere with the diving operation.

(f) Employee briefing.

(1) 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.

(2) 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.

(g) 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.

(h) 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 operation.
(approved by the Office of Management and Budget under control number 1218-0069)

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982]

§ 1910.422 Procedures during dive.

§ 1910.422 Procedures during dive.
(a) General. The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.
(b) Water entry and exit.
(1) A means capable of supporting the diver shall be provided for entering and exiting the water.
(2) The means provided for exiting the water shall extend below the water surface.
(3) A means shall be provided to assist an injured diver from the water in into a bell.
(c) Communications.
(1) 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.
(2) An operational two-way communication system shall be available at the dive location to obtain emergency assistance.
(d) Decompression tables. Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.
(e) Dive profiles. A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.
(f) Hand-held power tools and equipment.
(1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.
(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.
(g) Welding and burning.
(1) 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.
(2) The welding machine frame shall be grounded.
(3) 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.
(4) Insulated gloves shall be provided to divers performing welding and burning operations.
(5) 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.
(h) Explosives.
(1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of § 19 10.109 and § 1926.912 of Title 29 of the Code of Federal Regulations.
(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.
(3) Explosives shall not be detonated while the diver is in the water.
(i) Termination of dive. The working interval of a dive shall be terminated when:
(1) A diver requests termination;
(2) A diver fails to respond correctly to communications or signals from a dive team member;
(3) Communications are lost and can not be quickly re-established between the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or
(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

§ 1910.423 Post-dive procedures.
(a) General. The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.
(b) Precautions.

(1) 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.
(2) For any dive outside the no-decompression limits, deeper than breathing 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).
(c) Recompression capability.
(1) 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.
(2) A decompressing 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.
(3) The decompression chamber shall be:
(i) Dual-lock;
(ii) Multiplace; and
(iii) Located within 5 minutes of the dive location.
(4) 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.
(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.
(6) 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).
(d) Record of dive.
(1) The following information shall be recorded and maintained for each diving operation:
(i) Names of the dive team members including the designated person-in-charge;
(ii) Date, time, location;
(iii) Diving modes used;
(iv) General nature of work performed;
(v) Approximate underwater and surface conditions (visibility, water temperature and current);
(vi) Maximum depth and bottom time for each diver.
(2) 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.
(3) 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.
(e) Decompression procedure assessment. The employer shall:
(1) 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;
(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and
(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the

incident of decompression sickness.

(The information collection requirements contained in paragraphs (d) and (e) were approved by the Office of Management and Budget under control number 1218-0069) [42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

SPECIFIC OPERATIONS PROCEDURES

§ 1910.424 SCUBA diving.

§ 1910.424 SCUBA diving.

(a) General. Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) Limits. SCUBA diving shall not be conduced:

(1) At depths deeper than 130 fsw;

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

(3) Against currents exceeding one (1) knot unless line-tended: or

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

(c) Procedures.

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

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

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

(4) 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 under water breathing apparatus.

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

§ 1910.425 Surface-supplied air diving.

§ 1910.425 Surface-supplied air diving.

(a) General. Employers engaged in surface-supplied air diving shall comply with the following requirements. unless othenvise specified.

(b) Limits.

(1) Surface-supplied air diving shall not bc 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.

(2) 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.

(3) 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.

(c) Procedures.

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

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

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

(4) 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.

(5) 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 inwatcr stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving

§ 1910.426 Mixed-gas diving

(a) General. Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

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

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

(i) 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

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

(c) Procedures.

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

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

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

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

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

(6) 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 bc provided to divers in the water.

(7) 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.

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

(9) 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 nodecompression limits; or

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

§ 1910.427 Liveboating

§ 1910.427 Liveboating

(a) General. Employers engaged in diving operations involving liveboating shall comply with the following requirements.

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

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

(2) 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;

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

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

(5) In other than daylight hours.

(c) Procedures.

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

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

(3) 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.

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

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

EQUIPMENT PROCEDURES AND REQUIREMENTS

§ 1910.430 Equipment.

§ 1910.430 Equipment.

(a) General.

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

(2) 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.

(b) Air compressor system.

(1) 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.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

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

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (C02) greater than 1,000 p/m;
(iii) A level of oil mist greater than 5 milligrams per cubic meter; or
(iv) A noxious or pronounced odor.
(4) The output of air compressor systems shall be tested for air purity every 6 months 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.
(c) Breathing gas supply hoses.
(1) Breathing gas supply hoses shall:
(i) Have a working pressure of at least equal to the working pressure of the total breathing gas system:
(ii) Have a rated bursting pressure at least equal to 4 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.
(2) 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.
(3) Umbilicals shall:
(i) Be marked in IO-ft. increments to 100 feet beginning at the diver's end, and in 50-ft. increments thereafter;
(ii) Be made of kink-resistant materials; and
(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.
(d) Buoyancy control.
(1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.
(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.
(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.
(4) 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, and oral inflation device, and an exhaust valve shall be used for SCUBA diving.
(e) Compressed gas cylinders. Compressed gas cylinders shall:
(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.
(2) Be stored in a ventilated area and protected from excessive heat;
(3) Be secured from falling; and
(4) Have shut-off valves recessed in the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.
(f) Decompression chambers.
(1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.
(2) Each 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.
(3) Each decompression chamber shall be equipped with:
(i) Means to maintain the atmosphere below a level of 25 percent 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.
(g) Gauges and timekeeping devices.
(1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.
(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.
(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.
(4) A timekeeping device shall be available at each dive location.
(h) Masks and helmets.
(1) Surface-supplied air and mixed-gas masks

and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) 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 carbondioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) Oxygen safety.

(1) Equipment used with oxygen or mixtures containing over forty percent (40%) **by** volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and corn - pressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) Weights and harnesses.

(1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) 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.

(The information collection requirements contained in paragraph (a)(2) were approved by the Office of Management and Budget under control number 1218-0069) [39 FR 23502, June 27, 1974 as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

RECORDKEEPIKC

§ 1910.440 Record keeping requirements.

§ 1910.440 Recordkeeping requirements.

(a) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or 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 any injuries or illnesses.

(b) Availability of records.

(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, Department of Health, Education and Welfare of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-(i). Safe practices manuals (§ 1910.420), depth-time profiles (§ 1910.422), recordings of dives (§ 1910.423), decompression procedure assessment evaluations (§ 1910.423), and records of hospitalizations (§ 1910.440) 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 (§ 1910.430) shall also bc provided upon request to employees and their designated representatives.

(3) 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) (§ 1910.411)-5 years;

(ii) Safe practices manual (§ 1910.420)-current document only;

(iii) Depth-time profile (§ 1910.422)-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 of dive (§ 1910.423)-1 year, except 5 years where there has been incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§ 1910.423)-5 years;

(vi) Equipment inspections and testing records (§ 1910.430)-current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§ 1910.440)-5 years.

(4) After the expiration of the retention period of

any record required to be kept for five (5) 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 at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive ad employee medical records required by the standard; or

(ii) 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.

(Approved by the Office of Management and Budget under control number 1218-0058)
[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986]

APPENDIX A-EXAMPLES OF CONDITIONS WHICH MAY RESTRICT OR LIMIT EXPOSURE TO HYPERBARIC COSDITIOWS

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.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitary disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g. antihistamines, steroids, barbiturates, mood altering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

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). Juxta-articular osteonecrosis.

APPENDIX B-GUIDELINES FOR SCIENTIFIC DIVING

This appendix contains guidelines that will be used in conjunction with § 1910.401(a)(2)(iv) 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 the 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 non-proprietary.

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 scientist in training.

[50 FR 1050, Jan. 9, 1985]

federal register

DEPARTMENTOF TRANSPORTATION

Coast Guard

■

COMMERCIAL DIVING OPERATIONS

General Provisions

SUBCHAPTER V-MARINE OCCUPATIONAL SAFETY AND HEALTH STANDARDS

PART 197-GENERAL PROVISIONS

Subpart A-[Reserved]

Subpart B-Commercial Diving Operations

GENERAL

Sec.

EQUIPMENT

OPERATIONS

SPECIFIC DIVING MODE PROCEDURES

PERIODIC TESTS AND INSPECTIONS OF DIVING EQUIPMENT

RECORDS

AUTHORITY: 33 U.S.C. 1509; 43 U.S.C. 1333; 46 U.S.C. 3306, 3703, 6101; 49 CFR 1.46.

SOURCE: CGD 76-009, 43 FR 53683, Nov. 16, 1978, unless otherwise noted.

Subpart A - [Reserved]

Subpart B - Commercial Diving Operations

GENERAL

§ 197.200 Purpose of subpart.

This subpart prescribes rules for the design, construction, and use of equipment, and inspection, operation, and safety and health standards for commercial diving operations taking place from vessels and facilities under Coast Guard jurisdiction.

§ 197.202 Applicability.

(a> This subpart applies to commercial diving operations taking place at any deepwater port or the safety zone thereof as defined in 33 CFR 150; from any artificial island, installation, or other device on the Outer Continental Shelf and the waters adjacent thereto as defined in 33 CFR 147 or otherwise related to activities on the Outer Continental Shelf; and from all vessels required to have a certificate of inspection issued by the Coast Guard including mobile offshore drilling units regardless of their geographic location, or from any vessel connected with a deepwater port or within the deepwater port safety zone, or from any vessel engaged in activities related to the Outer Continental Shelf; except that this subpart does not apply to any diving operation-

(1) Performed solely for marine scientific research and development purposes by educational institutions;

(2) Performed solely for research and development for the advancement of diving equipment and technology; or

(3) Performed solely for search and rescue or related public safety purposes by or under the control of a governmental agency.

(b) Diving operations may deviate from the requirements of this subpart to the extent necessary to prevent or minimize a situation which is likely to cause death, injury, or major environmental damage. The circumstances leading to the situation, the deviations made, and the corrective action taken, if appropriate, to reduce the possibility of recurrence shall be recorded by the diving supervisor *in* the logbook as required by §197.482(c).

§ 197.204 Definitions.

As used in this subpart:

"*ACFM*" means actual cubic feet per minute.

"*ANSI Code1*" means the B31.1 American National Standards Institute "Code for Pressure Piping, Power Piping."

"*ASME Code*" means the American Society of Mechanical Engineers "Boiler and Pressure Vessel Code."

"*ASME PVHO-1*" means the ANSI/ASME standard "Safety Standard for Pressure Vessels for Human Occupancy."

"*ATA*" means a measure of pressure expressed in terms of atmosphere absolute (includes barometric pressure).

"*Bell*" means a compartment either at ambient pressure (open bell) or pressurized (closed bell) that allows the diver to be transported to and from the underwater work site, allows the diver access to the surrounding environment, and is capable of being used as a refuge during diving operations.

"*Bottom time*" means the total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time to the next whole minute that the diver begins ascent.

"*Breathing gas/breathing mixture*" means the mixed-*gas*, oxygen, or air as appropriate supplied to the diver for breathing.

"*Bursting pressure*" means the pressure at which a pressure containment device would fall structurally.

'*Commercial diver*" means a diver engaged *in* underwater work for hire excluding sport and recreational diving and the instruction thereof.

"*Commercial diving operation*" means all activities in support of a commercial diver.

"*Cylinder*" means a pressure vessel for the storage of gases under pressure.

"*Decompression chamber*" means a pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system especially equipped to recompress, decompress, and treat divers.

"*Decompression sickness*" means a condition caused by the formation of gas or gas bubbles in the blood or body *tissue* as a result of pressure reduction.

"*Decompression table*" means a profile or set of profiles of ascent rates and breathing mixtures designed to reduce the pressure *on* a diver safely to atmospheric pressure after the diver has been exposed to a specific depth and bottom time.

"*Depth*" means the maximum pressure expressed in feet of seawater attained by a diver and is used to express the depth of a dive.

"*Dive location*" means that portion of a vessel or facility from which a diving operation is conducted.

"*Dive team*" means the divers and diver support personnel involved in a diving operation, including the diving supervisor.

'*Diver*" means a person working beneath the surface, exposed to hyperbaric conditions, and using underwater breathing apparatus.

"*Diver-carried reserve breathing gas"* means a supply of air or mixed-gas, as appropriate, carried by the diver in addition to the primary or secondary breathing gas supplied to the diver.

"*Diving installation*" means all of the equipment used in support of a commercial diving operation.

"Diving *mode"* means a type of diving requiring SCUBA, surface-supplied air, or surface-supplied mixed-gas equipment, with related procedures and techniques.
"Diving stage" means a suspended platform constructed to carry one or more divers and used for putting divers into the water and bringing them to the surface when in-water decompression or a heavy-weight diving outfit is used.
"Diving supervisor" means the person having complete responsibility for the safety of a commercial diving operation including the responsibility for the safety and health of all diving personnel in accordance with this subpart.
"Facility" means a deepwater **port,** or an artificial island, installation, or other device on the Outer Continental Shelf subject to Coast Guard jurisdiction.
"*Fsw*" means feet of seawater (or equivalent static pressure head).
"Gas embolism" means a condition caused by expanding gasses, which have been taken into and retained in the lungs while breathing under pressure, being forced into the blood-stream or other tissues during ascent or decompression.
"Heavy-n-eight diving outjit" means diver-worn surface-supplied deep-sea dress.
"Hyperbaric conditions" means pressure conditions in excess of surface atmospheric pressure.
"injurious corrosion" means an advanced state of corrosion which may impair the structural integrity or safe operation of the equipment.
"Liveboating" means the support of a surfaced-supplied diver from a vessel underway.
"Maximum working pressure" means the maximum pressure to which a pressure containment device can be exposed under operating conditions (usually the pressure setting of the pressure relief device).
"No-decompression limits" means the air depth and bottom time limits of appendix A.
"Pressure vessel" means a container capable of withstanding an internal maximum working pressure over 15 psig.
"*Psi(g)*" means pounds per square inch (gage).
"*P VHO*" means pressure vessel for human occupancy but does not include pressure vessels for human occupancy that may be subjected to external pressures in excess of 15 psig but can only be subjected to maximum internal pressures of 15 psig or less (i.e., submersibles, or one atmosphere observation bells).
"Saturation diving" means saturating a diver's tissues with the inert gas in the breathing mixture to allow an extension of bottom time without additional decompression.
"SCUBA diving" means a diving mode in which the diver is supplied with a compressed breathing mixture from diver carried equipment.
"Standby diver" means a diver at the dive location available to assist a diver in the water.
"Surface-supplied air diving" means a diving mode in which the diver is supplied from the dive location or bell with compressed breathing air including oxygen or oxygen enriched air if supplied for treatment.
"Surface-supplied mixed-gas diving" means a diving mode in which the diver is supplied from the dive location or bell with a compressed breathing mixture other than air.
"*Timekeeping device"* means a device for measuring the time of a dive in minutes.
"Treatment table" means a depth, time, and breathing gas profile designed to treat a diver for decompression sickness.
"Umbilical" means the hose bundle between a dive location and a diver or bell, or between a diver and a bell, that supplies the diver or bell with a life-line, breathing gas, communication, power, and heat as appropriate to the diving mode or conditions.
"Vessel" means any waterborne craft including mobile offshore drilling units required to have a Certificate of Inspection issued by the Coast Guard or any waterborne craft connected with a dccpwatcr **port** or within the dccpwater port safety zone, or any waterborne craft engaged in activities related to the Outer Continental Shelf.
"Volume tank" means a pressure vessel connected to the outlet of a compressor and used as an air reservoir.
"Working pressure" means the pressure to which a pressure containment device is exposed at any particular instant during normal operating conditions.

§ 197.205 Availability of standards.

(a) Several standards have been incorporated by reference in this subchapter. The incorporation by reference has been approved by the Director of the FEDERAL REGISTER under the provisions of 1 CFR Part 5 1.
(b) The standards are available from the appropriate organizations whose addresses arc listed below:
(1) American National Standards Institute, 1430 Broadway, New York, NY 10018.
(2) American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

§ 197.206 Substitutes for required equipment, materials, apparatus, arrangements, procedures, or tests.

(a) The Coast Guard may accept substitutes for equipment, materials, apparatus, arrangements, procedures, or tests required in this subpart if the substitute provides an equivalent level of safety.
(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, material, apparatus, arrangement, procedure, or test is unreasonable or impracticable, the Commandant may permit the use of altemate equipment, material, apparatus, arrangement, procedure, or test to such an extent and upon such condition as will insure, to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subpart.

§ 197.208 Designation of person-in-charge.

(a) The owner or agent of a vessel or facility without a designated master shall designate, in writing, an individual to be the person-in-charge of the vessel or facility.
(b) Where a master is designated, the master is the person-in-charge.

§ 197.210 Designation of diving supervisor.

The name of the diving supervisor for each commercial diving operation shall be-
(a) Designated in writing; and
(b) Given to the person-in-charge prior to the commencement of any commercial diving operation.

EQUIPMENT

§ 197.300 Applicability.

(a) Each diving installation used on each vessel or facility subject to this subpart must meet the requirements of this subpart.
(b) In addition to the requirements of this subpart, equipment which is permanently installed on vessels and is part of the diving installation must meet Subchapters F and J of this chapter.
(c) All repairs and modifications to pressure vessels used for commercial diving operations must be made in accordance with the requirements of section VIII, division 1 or division 2 of the ASME Code, ASME PVHO-1, part 54 of this chapter, or 49 CFR 173.34, as applicable.
(d) All repairs and modifications to pressure piping used for commercial diving operations must be made in accordance with the requirements of the ANSI Code or Part 56 of this chapter, as applicable.

§ 197.310 Air compressor system.

A compressor used to supply breathing air to a diver must have-
(a) A volume tank that is-
(I) Built and stamped in accordance with section VIII, division 1 of the ASME Code with-
(i) A check valve on the inlet side;
(ii) A pressure gage;
(iii> A relief valve; and
(iv) A drain valve; and
(2) Tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462;
(b) Intakes that are located away from areas containing exhaust fumes of internal combustion engines or other hazardous contaminants;
(c) An efficient filtration system; and
(d) Slow-opening shut-off valves when the maximum allowable working pressure of the system exceeds 500 psig.

§ 197.312 Breathing supply hoses.

(a) Each breathing supply hose must-
(I) Have a maximum working pressure that is equal to or exceeds-
(i) The maximum working pressure of the section of the breathing supply system in which used; and
(ii) The pressure equivalent of the maximum depth of the dive relative to the supply source plus 100 psig;
(2) Have a bursting pressure of four times its maximum working pressure;
(3) Have connectors that-
(i) Are made of corrosion-resistant material;
(ii> Are resistant to accidental disengagement; and
(iii) Have a maximum working pressure that is at least equal to the maximum working pressure of the hose to which they are attached; and
(4) Resist kinking by-
(i) Being made of kink-resistant materials; or
(ii> Having exterior support.
(b) Each umbilical must-
(1) Meet the requirements of paragraph (a> of this section; and
(2) Be marked from the diver or open bell end in I O-foot intervals to 100 feet and in 50-foot intervals thereafter.

§ 197.314 First aid and treatment equipment.

(a) Each dive location must have-
(1) A medical kit approved by a physician that consists of-
(i) Basic first aid supplies; and
(ii) Any additional supplies necessary to treat minor trauma and illnesses resulting from hyperbaric exposure;
(2) A copy of an American Red Cross Standard First Aid handbook;
(3) A bag-type manual resuscitator with transparent mask and tubing; and
(4) A capability to remove an injured diver from the water.
(b) Each diving installation must have a two-way communications system to obtain emergency assistance except when the vessel or facility ship-to-shore, two-way communications system is readily available.
(c) Each dive location supporting mixed-gas dives, dives deeper than 130 fsw, or dives outside the no-decompression limits must meet the requirements of paragraph (a) of this section and have-
(1) A decompression chamber;
(2) Decompression and treatment tables;
(3) A supply of breathing gases sufficient to treat for decompression sickness;
(4) The medical kit required by paragraph (a)(1) of this section that is-
(i) Capable of being carried into the decompression chamber; and
(ii) Suitable for use under hyperbaric conditions; and
(5) A capability to assist an injured diver into the decompression chamber.

§ 197.318 Gages and timekeeping devices.

(a) A gage indicating diver depth must be at each dive location for surface-supplied dives.
(b) A timekeeping device must be at each dive location.

§ 197.320 Diving ladder and stage.

(a) Each diving ladder must-
(I) Be capable of supporting the weight of at least two divers;
(2) Extend 3 feet below the water surface;
(3) Be firmly in place;
(4) Be available at the dive location for a diver to enter or exit the water unless a diving stage or bell is provided: and
(5) Be-(i) Made of corrosion-resistant material; or
(ii) Protected against an maintained free from injurious corrosion.
(b) Each diving stage must-
(1) Be capable of supporting the weight of at least two divers;
(2) Have an open-grating platform;
(3) Be available for a diver to enter or exit the water from the dive location and for in-water decompression if the diver is-
(i) Wearing a heavy-weight diving outfit; or
(ii) Diving outside the no-decompression limits, except when a bell is provided; and
(4) Be-(i) Made of corrosion-resistant material; or
(ii) Protected against and maintained free from injurious corrosion.

§ 197.322 Surface-supplied helmets and masks.

(a) Each surface-supplied helmet or mask must have-
(1) A nonretum valve at the attachment point between helmet or mask and umbilical that closes readily and positively;
(2) An exhaust valve; and
(3) A two-way voice communication system between the diver and the dive location or bell.
(b) Each surface-supplied air helmet or mask must-
(1) Ventilate at least 4.5 ACFM at any depth at which it is operated; or
(2) Be able to maintain 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.

§ 197.324 Diver's safety harness.

Each safety harness used in surface-supplied diving must have-
(a) A positive buckling device; and
(b) An attachment point for the umbilical life line that-
(1) Distributes the pulling force of the umbilical over the diver's body; and
(2) Prevents strain on the mask or helmet.

§ 197.326 Oxygen safety.

(a) Equipment used with oxygen or oxygen mixtures greater than 40 percent by volume must be designed for such use.

(b) Oxygen systems with pressures greater than I .25 psig must have slow-opening shut-off valves except pressure boundary shut-off valves may be ball valves.

§ 197.328 PVHO-General.

(a) Each PVHO, contracted for or purchase after February 1, 1979, must be built and stamped in accordance with ASME PVHU- 1.
(b) Each PVHO, contracted for or constructed before February I , 1979, and not Coast Guard approved, must be submitted to the Coast Guard for approval prior to February 1, 1984.
(c) To be approved under paragraph (b), a PVHO must be-
(1) Constructed in accordance with Part 54 of this chapter; or
(2) Be built in accordance with section VIII, division 1 or division 2 of the ASME Code; and-
(i) Have the plans approved in accordance with § 54.01-18 of this chapter;
(ii) Pass the radiographic and other survey tests of welded joints required by section VIII, division 1 or division 2, as appropriate, of the ASME Code; and
(iii> Pass-(A) The hydrostatic test described in § 54. IO- IO of this chapter; or
(B) The pneumatic test described in $54.10-15 of this chapter and such additional tests as the Officer-in-Charge Marine Inspection (OCMI) may require,
(d) Each PVHU must-
(1) Have a shut-off valve located within 1 foot of the pressure boundary on all piping penetrating the pressure boundary;
(2) Have a check valve located within 1 foot of the pressure boundary on all piping exclusively carrying fluids into the PVHU;
(3) Have the pressure relief device required by ASME PVHU- I ;
(4) Have a built-in breathing system with at least one mask per occupant stored inside each separately pressurized compartment;
(5) Have a two-way voice communications system allowing communications between an occupant in one pressu~zed compartment of the PVHU and-
(i) The diving supervisor at the dive location;
(ii) Any divers being supported from the same PVHO; and
{iii) Occupants of other separately pressu~zed compartments of the same PVHO;
(6) If designed to mechanically couple to another PVHO, have a two-way communications system allowing communications between occupants of each PVHU when mechanically coupled:
(7) Have a pressure gage in the interior of each compartment that is-
(i) Designed for human occupancy; and
(ii) Capable of having the compartment pressure controlled from inside the PVHU;
(8) Have viewports that allow observation of occupants from the outside;
(9) Have viewports that meet the requirements of ASME PVHU- 1 except those PVHO's approved under paragraph (b) of this section which have nonacrylic viewports;
(10) Have means of illumination sufficient to allow an occupant to-
(i) Read gages; and
(ii) Operate the installed systems within each compartment;
(I I) Be designed and equipped to minimize sour&es of combustible materials and ignition;
(12) Have a protective device on the inlet side of PVHU exhaust lines;
(13) Have a means of extinguishing a fire in the interior;
(14) Have a means of maintaining the oxygen content of the interior atmosphere below 25 percent surface equivalent by volume when pressu~zed with air as the breathing mixture.
(I 5) Have a means of maintaining the interior atmosphere below 2 percent surface equivalent carbon dioxide by volume;
(16) Have a means of overriding and controlling from the exterior all interior breathing and pressure supply controls;
(1 7) Have a speech unscrambler when used with mixed-gas;
(I 8) Have interior electrical systems that are designed for the environment in which they will operate to minimize the risk of fire, electrical shock to personnel, and galvanic action of the PVHU; and
(19) Be tested after every repair, modification, or alteration to the pressure boundaries as required by § 197.462.

§ 197.330 PVHO-Closed bells.

(a) Except as provided in paragraph (b) of this section, each closed bell must meet the requirements of § ~97,328 and-
(1) Have underwater breathing apparatus for each occupant stored inside each separately pressu~zed compartment;

(2) Have an umbilical;
(3) Have lifting equipment attached to the closed bell capable of returning the occupied closed bell when fully flooded to the dive location;
(4) Be capable of recompressing on the surface to the maximum design diving depth;
(5) Be constructed and equipped as required by § 197.332;
(6) Have an emergency locating device designed to assist personnel on the surface in acquiring and maintaining contact with the submerged PVHU if the umbilical to the surface is severed;
(7) Have a capability to remove an injured diver from the water; and
(8) Have a life support capability for the intact closed bell and its occupants for-
(i) Twelve hours after an accident severing the umbilical to the surface when the umbilical to the surface is the only installed means of retrieving the closed bell; or
(ii) A period of time, at least equal to 1 hour plus twice the time required to retrieve the bell from its designed operating depth and attach an auxiliary life-support system, after an accident severing the umbilical to the surface when the umbilical is one of the two independent installed means of retrieving the closed bell, each meeting the requirements of paragraph (a)(3) of this section
(b) A closed bell that does not meet the requirements of paragraphs (a)(3), (a)(4), and (a)(5) of this section, must be capable of attachment to another PVHO that-
(1) Allows the transfer of personnel and diver's equipment under pressure from the closed bell to the PVHO;
(2) Meets the requirements of paragraph (a)(3) of this section;
(3) Is capable of attachment to a decompression chamber meeting the requirements of paragraphs (a)(4) and (a)(5) of this section; and
(4) Allows the transfer of personnel and diver's equipment under pressure from the PVHU to the decompression chamber.

§ 197.332 PVHO-Decompression chambers.

Each decompression chamber must-
(a) Meet the requirements of § 197.328;
(b) Have internal dimensions sufficient to accommodate a diver lying in a horizontal position and another person tending the diver;
(c) Have a capability for ingress and egress of personnel and equipment while the occupants are under pressure;
(d) Have a means of operating all installed man-way locking devices, except disabled shipping dogs, from both sides of a closed hatch;
(e) Have interior illumination sufficient to allow visual observation, diagnosis, and medical treatment of an occupant.
(f) Have one bunk for each two occupants;
(g) Have a capability that allows bunks to be seen over their entire lengths from the exterior;
(h) Have a minimum pressure capability of-
(I) 6 ATA. when used for diving to 300 fsw; or
(2) The maximum depth of the dive, when used for diving operations deeper than 300 fsw, unless a closed bell meeting the requirements of § 197.330(a) (3), (4), and (5) is used;
(i) Have a minimum pressurization rate of 2 ATA per minute to 60 fsw and at least 1 ATA per minute thereafter,
(j) Have a decompression rate of 1 ATA per minute to 33 fsw;
(k) Have an external pressure gage for each pressurized compartment;
(I) Have a capability to supply breathing mixtures at the maximum rate required by each occupant doing heavy work; and
(m) Have a sound-powcrcd headset or telephone as a backup to the communications system required by § 197.328(c) (5) and (6), except when that communications system is a sound-powered system.

§ 197.334 Open diving bells.

Each open diving bell must-
(a) Have an upper section that provides an envelope capable of maintaining a bubble of breathing mixture available to a diver standing on the lower section of the platform with his body through the open bottom and his head in the bubble;
(b) Have lifting equipment capable of returning the occupied open bell to the dive location;
(c) Have an umbilical; and
(d) Be-(1) Made of corrosion-resisting material; or
(2) Protected against and maintained free from injurious corrosion.

§ 197.336 Pressure piping.

Piping systems that are not an integral part of the vessel or facility, carrying fluids under pressure exceeding I5 psig must-

(a) Meet the ANSI Code;
(b) Have the point of connection to the integral piping system of the vessel or facility clearly marked; and
(c) Be tested after every repair, modification, or alteration to the pressure boundaries as set forth in § 197.462.

§ 197.338 Compressed gas cylinders.

Each compressed gas cylinder must-
(a) Be stored in a ventilated area;
(b) Be protected from excessive heat;
(c) Be prevented from falling;
(d) Be tested after any repair, modification, or alteration to the pressure boundaries as set forth in § 197.462; and
(e) Meet the requirements of-
(I) Part 54 of this Chapter; or
(2) 49 CFR 173.34 and 49 CFR 178 Subpart C.

§ 197.340 Breathing gas supply.

(a) A primary breathing gas supply for surface-supplied diving must be sufficient to support the following for the duration of the planned dive:
(I) The diver;
(2) The standby diver;
(3) The decompression chamber, when required by § 197.432(e)(2) or by § 197.434(a) for the duration of the dive and for one hour after completion of the planned dive.
(4) A decompression chamber when provided but not required by this subpart.
(5) A closed bell when provided or required by § 197.434(d);
(6) (a)An open bell when provided or required by § 197.432(e)(4) or by § 197.434(c).
(b) A secondary breathing gas supply for surface-supplied diving must be sufficient to support the following:
(1) The diver while returning to the surface;
(2) The diver during decompression;
(3) The standby diver,
(4) The decompression chamber when required by § 197.432(e)(2) or by § 197.434(a) for the duration of the dive and one hour after the completion of the planned dive.
(5) The closed bell while returning the diver to the surface;
(6) The open bell while returning the diver to the surface.
(c) A diver-carried reserve breathing gas supply for surface-supplied diving must be sufficient to allow the diver to-
(1) Reach the surface;
(2) Reach another source of breathing gas; or
(3) Be reached by a standby diver equipped with another source of breathing gas for the diver.
(d) A primary breathing gas supply for SCUBA diving must be sufficient to support the diver for the duration of the planned dive through his return to the dive location or planned pickup point.
(e) A diver-carried reserve breathing gas supply for SCUBA diving must be sufficient to allow the diver to return to the dive location or planned pickup point from the greatest depth of the planned dive.
(f) Oxygen used for breathing mixtures must-
(1) Meet the requirements of Federal Specification BB-0-925a; and
(2) Be type 1 (gaseous) grade A or B.
(g) Nitrogen used for breathing mixtures must-
(1) Meet the requirements of Federal Specification BB-N-411c;
(2) Be type I (gaseous);
(3) Be class I (oil free); and
(4) Be grade A, B, or C.
(h) Helium used for breathing mixtures must be grades A, B, or C produced by the Federal Government, or equivalent.
(i) Compressed air used for breathing mixtures must-
(1) Be 20 to 22 percent oxygen by volume;
(2) Have no objectionable odor; and
(3) Have no more than-
(i) 1,000 parts per million of carbon dioxide;
(ii) 20 parts per million of carbon monoxide;
(iii) 5 milligrams per cubic meter of solid and liquid particulates including oil; and
(iv) 25 parts per million of hydrocarbons (includes methane and all other hydrocarbons expressed as methane).

§ 197.342 Buoyancy-changing devices.

(a) A dry suit or other buoyancy-changing device not directly connected to the exhaust valve of the helmet or mask must have an independent exhaust valve.
(b) When used for SCUBA diving, a buoyancy-changing device must have an inflation source separate from the breathing gas supply.

§ 197.344 Inflatable flotation devices.

An inflatable flotation device for SCUBA diving must-

(a) Be capable of maintaining the diver at the surface in a faceup position;
(b) Have a manually activated inflation device;
(d) Have an oral inflation device;
(e) Have a manually operated exhaust valve.

§ 197.346 Diver's equipment.

(a) Each diver using SCUBA must have-
(1) Self-contained underwater breathing equipment including-
(i) A primary breathing gas supply with a cylinder pressure gauge readable by the diver during the dive; and
(ii) A diver-carried reserve breathing gas supply provided by-
(A) A manual reserve (J valve); or
(B) An independent reserve cylinder connected and ready for use;
(2) A face mask;
(3) An inflatable flotation device;
(4) A weight belt capable of quick release;
(5) A knife;
(6) Swim fins or shoes;
(7) A diving wristwatch; and
(8) A depth gauge.
(b) Each diver using a heavyweight diving outfit must-
(1) Have a helmet group consisting of helmet, breastplate, and associated valves and connections;
(2) Have a diving dress group consisting of a basic dress that encloses the body (except for head and hands) in a tough, waterproof cover, gloves, shoes, weight assembly, and knife;
(3) Have a hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer; and
(4) Be provided with a helmet cushion and weighted shoes.
(c) Each surface-supplied dive operation using a heavyweight diving outfit must have an extra breathing gas hose with attaching tools available to the diver.
(d) Each diver using a lightweight diving outfit must have-
(1) A safety harness;
(2) A weight assembly capable of quick release;
(3) A mask group consisting of a lightweight mask and associated valves and connections;
(4) A diving dress group consisting of wet or dry diving dress, gloves, shoes or fins, and knife; and
(5) A hose group consisting of the breathing gas hose and fittings, the control valve, the lifeline, communications cable, and a pneumofathometer (if the breaking strength of the communications cable is at least equal to that required for the lifeline, the communications cable can serve as the lifeline).
(e) Each surface-supplied air dive operation within the no-decompression limits and to depths of 130 fsw or less must have a primary breathing gas supply at the dive location.
(f) Each surface-supplied dive operation outside the no-compression limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture must have at the dive location-
(1) A primary breathing gas supply; and
(2) A secondary breathing gas supply.
(g) Each diver diving outside the no-decompression limits, deeper than 130 fsw, or using mixed-gas must have a diver-carried reserve breathing gas supply except when using a heavy-weight diving outfit or when diving in a physically confining area.

OPERATIONS

§ 197.400 Applicability.

Diving operations may only be conducted from a vessel or facility subject to the subpart if the regulations in this subpart are met.

§ 197.402 Responsibilities of the person-in-charge.

(a) The person-in-charge shall-
(1) Be fully cognizant of the provisions of this subpart;
(2) Prior to permitting any commercial diving operation to commence, have-
(i) The designation of the diving supervisor for each diving operation as required by § 197.2 10;
(ii) A report on-
(A) The nature and planned times of the planned diving operation; and
(B) The planned involvement of the vessel or facility, its equipment, and its personnel in the diving operation.
(b) Prior to permitting any commercial diving operation involving liveboating to commence, the person-in-charge shall insure that-
(1) A means of rapid communications with the diving supervisor while the diver is entering, in, or leaving the water is established; and

(2) A boat and crew for diver pickup in the event of an emergency is provided.
(c) The person-in-charge shall insure that a boat and crew for SCUBA diver pickup is provided when SCUBA divers are not line-tended from the dive location.
(d) The person-in-charge shall insure that the vessel or facility equipment and personnel are kept clear of the dive location except after coordinating with the diving supervisor.

§ 197.404 Responsibilities of the diving supervisor.

(a) The diving supervisor shall-
(I) Be fully cognizant of the provisions of this subpart;
(2) Be fully cognizant of the provisions of the operations manual required by § 197.420;
(3) Insure that diving operations conducted from a vessel or facility subject to this subpart meet the regulations in this subpart;
(4) Prior to the commencement of any commercial diving operation, provide the report required by § 197.402 to the person-in-charge;
(5) Coordinate with the person-in-charge any changes that are made to the report required by § 197.402; and
(6) Promptly notify the person-in-charge of any diving related casualty, accident, or injury.
(b) the diving supervisor is in charge of the planning and execution of the diving operation including the responsibility for the safety and health of the dive *team.*

§ 197.410 Dive procedures.

(a) The diving supervisor shall insure that-
(I) Before commencing diving operations, dive team members are briefed on-
(i) The tasks to be undertaken;
(ii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and
(iii) Any modifications to the operations manual or procedures including safety procedures necessitated by the specific diving operation;
(2) The breathing gas supply systems, masks, helmets, thermal protection, when provided, and bell lifting equipment, when a bell is provided or required, are inspected prior to each diving operation;
(3) Each diver is instructed to report any physical problems or physiological effects including aches, pains current illnesses, or symptoms of decompression sickness prior to each dive;
(4) A depth, bottom time profile, including any breathing mixture changes, is maintained at the dive location for each diver during the dive, except that SCUBA divers shall maintain their own profiles;
(5) A two-way voice communication system is used between-
(i) Each surface-supplied diver and a dive team member at the dive location or bell (when provided); and
(ii) The bell (when provided) and the dive location;
(6) A two-way communication system is available at the dive location to obtain emergency assistance;
(7) After the completion of each dive-
(i) The physical condition of the diver is checked by-
(A) Visual observation; and
(B) Questioning the diver about his physical well-being;
(ii) The diver is instructed to report any physical problems or adverse physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness or gas embolism;
(iii) The diver is advised of the location of an operational decompression chamber; and
(iv) The diver is alerted to the potential hazards of flying after diving;
(8) For any dive outside the no-decompressjon limits, deeper than 130 fsw, or using mixed-gas as a breathing mixture-
(i) A depth, time, decompression profile including breathing mixture changes is maintained for each diver at the dive location;
(ii) The diver is instructed to remain awake and in the vicinity of the dive location decompression chamber for at least one hour after the completion of a dive, decompression, or treatment; and
(iii) A dive team member, other than the diver, is trained and available to operate the decompression chamber; and
(9) When decompression sickness or gas embolism is suspected or symptoms are evident, a report is completed containing-
(i) The investigation for each incident including-
(A) The dive and decompression profiles;
(B) The composition, depth, and time of breathing mixture changes;
(C) A description of the symptoms including depth and time of onset; and
(D) A description and results of the treatment;
(ii) The evaluation for each incident based on-
(A) The investigation;
(B) Consideration of the past performance of the decompression table used; and

(C) Individual susceptibility; and

when-
(1) A diver requests termination;
(2) A diver fails to respond correctly to communications or signals from a dive team member;
(3) Communications are lost and cannot be quickly reestablished between-
(i) The diver and a dive team member at the dive location; or
(ii) The person-in-charge and the diving supervisor during liveboating operations; or
(4) A diver begins to use his diver-carried reserve breathing gas supply.

§ 197.420 Operations manual.

(a) The diving supervisor shall-
(1) Provide an operations manual to the person-in-charge prior to commencement of any diving operation; and
(2) Make an operations manual available at the dive location to all members of the dive team.
(b) The operations manual must be modified in writing when adaptation is required because of-
(1) The configuration or operation of the vessel or facility; or
(2) The specific diving operation as planned.
(c) The operations manual must provide for the safety and health of the divers.
(d) The operations manual must contain the following:
(1) Safety procedures and checklists for each diving mode used.
(2) Assignments and responsibilities of each dive team member for each diving mode used.
(3) Equipment procedures and checklists for each diving mode used.
(4) Emergency procedures for-
(i) Fire;
(ii) Equipment failure;
(iii) Adverse environmental conditions including, but not limited to, weather and sea state;
(iv) Medical illness; and
(v) Treatment of injury.
(5) Procedures dealing with the use of-
(i) Hand-held power tools;
(ii) Welding and burning equipment; and
(iii) Explosives.

SPECIFIC DIVING MODE PROCEDURES

§ 197.430 SCUBA diving.

The diving supervisor shall insure that-
(a) SCUBA diving is not conducted-
(1) Outside the no-decompression limits:
(2) At depths greater than 130 fsw;
(3) Against currents greater than one (1) knot unless line-tended; and
(4) If a diver cannot directly ascend to the surface unless line-tended;
(b) The SCUBA diver has the equipment required by § 197.346(a);
(c) A standby diver is available while a diver is in the water;
(d) A diver is line-tended from the surface or accompanied by another diver in the water in continuous visual contact during the diving operation;
(e) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver; and
(f) A boat is available for diver pickup when the divers arc not line-tended from the dive location.

§ 197.432 Surface-supplied air diving.

The diving supervisor shall insure that-
(a) Surface-supplied air diving is conducted at depths less than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;
(b) Each diving operation has a primary breathing gas supply;
(c) Each diver is continuously tended while in the water;
(d) When a diver is in a physically confining space, another diver is stationed at the underwater point of entry and is line-tending the diver;
(c) For dives deeper than 130 fsw or outside the no-decompression limits-
(I) Each diving operation has a secondary breathing gas supply;
(2) A decompression chamber is ready for use at the dive location;
(3) A diving stage is used except when a bell is provided;
(4) A bell is used for dives with an in-water decompression time greater than 120 minutes. except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space;

(5) A separate dive team member tends each diver in the water,
(6) A standby diver is available while a diver is in the water; and
(7) Each diver has a diver-carried reserve breathing gas supply except when using a heavy-weight diving outfit or when diving in a physically confining space; and
(f) The surface-supplied air diver has the equipment required by §197.346(b) or (d).

§ 197.434 Surface-supplied mixed-gas diving.

The diving supervisor shall insure that-
(a) When mixed-gas diving is conducted, a decompression chamber or a closed bell meeting the requirements of § 197.332 is ready for use at the dive location;
(b) A diving stage is used except when a bell is provided;
(c) A bell is used for dives deeper than 220 fsw or when the dive involves in-water decompression times greater than 120 minutes, except when the diver is using a heavy-weight diving outfit or is diving in a physically confining space;
(d) A closed bell is used for dives at depths greater than 300 fsw, except when diving is conducted in a physically-confining space;
(e) A separate dive team member tends each diver in the water;
(f) A standby diver is available during all nonsaturation dives;
(g) When saturation diving is conducted;
(I) A standby diver is available when the closed bell leaves the dive location until the divers are in saturation; and
(2) A member of the dive team at the dive location is a diver able to assist in the recovery of the closed bell or its occupants, if required;
(h) When closed bell operations are conducted, a diver is available in the closed bell to assist a diver in the water;
(i) When a diver is in a physically-confining space, another diver is stationed at the underwater point of entry and is line-tending the diver;
(j) Each diving operation has a primary and secondary breathing gas supply meeting the requirements of § 197.340; and
(k) The surface-supplied mixed gas diver has the equipment required by §197.346(b) or (d).

§ 197.436 Liveboating.

(a) During liveboating operations, the person-in-charge shall insure that-
(1) Diving is not conducted in seas that impede station-keeping ability of the vessel;
(2) Liveboating operations are not conducted-
(i) From 1 hour after sunset to 1 hour before sunrise; or
(ii) During periods of restricted visibility;
(3) The propellers of the vessel are stopped before the diver enters or exits the water; and
(4) A boat is ready to be launched with crew in the event of an emergency.
(b) As used in paragraph (a)(2)(ii) of this section, "restricted visibility" means any condition in which vessel navigational visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.
(c) During liveboating operations, the diving supervisor shah insure that-
(I) Diving is not conducted at depths greater than 220 fsw;
(2) Diving is not conducted in seas that impede diver mobility or work function;
(3) A means is used to prevent the diver's hose from entangling in the propellers of the vessel;
(4) Each diver carries a reserve breathing gas supply
(5) A standby diver is available while a diver is in the water;
(6) Diving is not conducted with in-water decompression times greater than 120 minutes; and
(7) The person-in-charge is notified before a diver enters or exits the water.

PERIODIC TESTS AND INSPECTION OF DIVING EQUIPMENT

§ 197.450 Breathing gas tests.

The diving supervisor shall insure that-
(a) The output of each air compressor is tested and meets the requirements of §197.340 for quality and quantity by means of samples taken at the connection point to the distribution system-
(1) Every 6 months; and
(2) After every repair or modification.
(b) Purchased supplied of breathing mixtures supplied to a diver are checked before being placed on line for-
(1) Certification that the supply meets the requirements of §197.340; and

(2) Noxious or offensive odor and oxygen percentage;
(c) Each breathing supply system is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for noxious or offensive odor and presence of oil mist; and
(d) Each breathing supply system, supplying mixed-gas to a diver, is checked, prior to commencement of diving operations, at the umbilical or underwater breathing apparatus connection point for the diver, for percentage of oxygen.

§ 197.452 Oxygen cleaning.

The diving supervisor shall ensure that equipment used with oxygen or oxygen mixtures greater than 40 percent by volume is cleaned of flammable materials-
(a) Before being placed into service;
(b) After any repair, alteration, modification, or suspected contamination.

§ 197.454 First aid and treatment equipment.

The diving supervisor shall ensure that medical kits are checked monthly to insure that all required supplies are present.

§ 197.456 Breathing supply hoses.

(a) The diving supervisor shall insure that-
(1) Each breathing supply hose is pressure tested prior to being placed into initial service and every 24 months thereafter to 1.5 times its maximum working pressure;
(2) Each breathing supply hose assembly, prior to being placed into initial service and after any repair, modification, or alteration, is tensile tested by;
(i) Subjecting each hose-to-fitting connection to a 200 pound axial load: and
(ii) Passing a visual examination for evidence of separation, slippage, or other damage to the assembly;
(3) Each breathing supply hose is periodically checked for-
(i) Damage which is likely to affect pressure integrity; and
(ii) Contamination which is likely to affect the purity of the breathing mixture delivered to the diver; and
(4) The open ends of each breathing supply hose are taped, capped, or plugged when not in use.
(b) To meet the requirements of paragraph (a)(3) of this section, each breathing supply hose must be-
(1) Carefully inspected before being shipped to the dive location;
(2) Visually checked during daily cooperation; and
(3) Checked for noxious or offensive odor before each diving operation.

§ 197.458 gauges and timekeeping devices.

The diving supervisor shall insure that-
(a) Each depth gauge and timekeeping device is tested or calibrated against a master reference gauge or timekeeping device every 6 months;
(b) A depth gauge is tested when a discrepancy exists in a depth gauge reading greater than 2 percent of full scale between any two gauges of similar range and calibration;
(c) A timekeeping device is tested when a discrepancy exists in a timekeeping device reading greater than one-quarter on a minute in a 4-hour period between any two timekeeping devices: and
(d) Each depth gauge and timekeeping device is inspected before diving operations are begun.

§ 197.460 Diving equipment.

The diving supervisor shall insure that the diving equipment designated for use in a dive under § 197.346 is inspected before each dive.

§ 197.462 Pressure vessels and pressure piping.

(a) The diving supervisor shall insure that each volume tank, cylinder, PVHO, and pressure piping system has been examined and tested every 12 months and after any repair, modification, or alteration to the extent necessary to determine that they are in condition and fit for the service intended.
(b) The following tests must be made to meet the annual requirements of paragraph (a) of this section;
(1) An internal and external visual examination for mechanical damage or deterioration. If a defect is found that may impair the safety of the pressure vessel, a hydrostatic test must be performed.
(2) A leak test.
(3) A pneumatic test.
(4) A hydrostatic test every fifth year instead of the pneumatic test.
(c) The following tests must be made after any repair, modification, or alteration to meet the requirements of paragraph (a) of this section;

(I) An internal and external visual examination for correctness and adequacy of repair, modification, or alteration.
(2) A leak test,
(3) A hydrostatic test when the repair, modification, or alteration affects the pressure boundary.
(d) When the pneumatic test on pressure vessels is conducted-
(I) The test pressure must be the maximum allowable working pressure stamped on the pressure vessel; and
(2) The test may be conducted only after suitable precautions are taken to protect personnel and equipment.
(e) When the pneumatic test on pressure piping is conducted;
(I) The test pressure must be no less that 90 percent of the setting of the relief device; and
(2) The test may be conducted only after suitable precautions are taken to protect personnel and equipment,
(f) When a hydrostatic test on a pressure vessel is made, the test pressure must be;
(I) I $^{1}/_{4}$ times the pressure stamped on the pressure vessel built to division 2 of the ASME Code; and
(2) 1 $^{1}/_{2}$times the pressure stamped on the pressure vessel built to division 1 of the ASME Code.
(g) When a hydrostatic test on pressure piping is conducted, the test must be conducted in accordance with the ANSI Code.
(h) When the leak test on pressure vessels or pressure piping is conducted;
(1) The test must be conducted with the breathing mixture normally used in service;
(2) The test must be conducted at the maximum allowable working pressure; and
(3) The test pressure must be maintained for a minimum of 10 minutes to *allow* checking all joints, connections, and regions of high stress for leakage.

RECORDS

§ 197.480 Logbooks.

(a) The person-in-charge of a vessel or facility required by 46 U.S.C. 201 to have an official logbook shall maintain the logbook on form CG-706.
(b) The person-in-charge of a vessel or facility not required by 46 U.S.C. 201 to have an official logbook, shall maintain, on board, a logbook for making the entries required by this subpart.
(c) The diving supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart.

§ 197.482 Logbook entries.

(a) The person-in-charge shall insure that the following information is recorded in the logbook for each commercial diving operation;
(I) Date, time, and location at the start and completion of dive operations.
(2) Approximate underwater and surface conditions (weather, visibility, temperatures and currents).
(3) Name of the diving supervisor.
(4) General nature of work performed.
(5) Repetitive dive designation or elapsed time since last hyperbaric exposure if less than 24 hours for each diver.
(6) Diving modes used.
(7) Maximum depth and bottom time for each diver.
(8) Name of person-in-charge.
(9) For each dive outside the no-decompressjon limits, deeper than 130 fsw, or using mixed gas, the breathing gases and decompression table designations used.
(10) When decompression sickness or gas embolism is suspected or symptoms are evident-
(i) The name of the diver; and
(ii) A description and results of treatment.
(1 I) For each fatality or any diving related injury or *illness* that results in incapacitation of more than 72 hours or requires any dive team member to be hospitalized for more than 24 hours-
(i) The date;
(ii) Time;
(iii) Circumstances; and
(iv) Extent of any injury or illness.
(c) The diving supervisor shall insure that the following is recorded in the logbook for each diving operation deviating from the requirements of this subpart;
(I) A description of the circumstances leading to the situation.
(2) The deviations made.
(3) The corrective action taken, if appropriate, to reduce the possibility of recurrence.
(d) The diving supervisor shall insure that a record of the following is maintained;
(1) The date and results of each check of the medical kits.
(2) The date and results of each test of the air *compressor.*

(3) The date and results of each check of breathing mixtures.
(4) The date and results of each check of each breathing supply system.
(5) The date, equipment, cleaned, general cleaning procedure, and names of persons cleaning the diving equipment for oxygen service.
(6) The date and results of each test of the breathing supply hoses and system.
(7) The date and results of each test of the breathing and gas supply system.
(8) The date and results of each test and inspection of each PVHO.
(10) The date and results of each inspection of the diving equipment.
(11) The date and results of each test and inspection of pressure piping.
(12) The date and results of each test and inspection of pressure piping.
(e) The diving supervisor shall insure that a notation concerning the location of the information required under paragraph (d) is made in the logbook.
NOTE: R.S. 4290 (46 U.S.C. 201) requires that certain entries be made in an official logbook in addition to the entries required by this section; and R.S. 4291 (46 U.S.C. 202) prescribes the manner of making those entries.

§ 197.484 Notice of casualty.

(a) In addition to the requirements of Subpart 4.05 of this chapter and 33 CFR 146.01-20, the person-in-charge shall notify the Officer-in-Charge Marine Inspection, as soon as possible after a diving casualty occurs, if the casualty involves any of the following:
(1) Loss of life.
(2) Diving-related injury to any person causing incapacitation for more than 72 hours.
(3) Diving-related injury to any person requiring hospitalization for more than 24 hours.
(b) The notice required by this section must contain the following:
(1) Name and official number (if applicable) of the vessel or facility.
(2) Name of the owner or agent of the vessel or facility.
(3) Name of the person-in-charge.
(4) Name of the diving supervisor.
(5) Description of the casualty including presumed cause.
(6) Nature and extent of the injury to persons.
(c) The notice required by this section is not required if the written report required by § 197.486 is submitted within 5 days of the casualty.

§ 197.486 Written report of casualty.

The person-in-charge of a vessel or facility for which a notice of casualty was made under § 197.484 shall submit a report to the Officer-in-Charge, Marine Inspection, as soon as possible after the casualty occurs, as follows:
(a) On Form CC-2692, when the diving installation is on a vessel.
(b) Using a written report, in narrative form, when the diving installation is on a facility. The written report must contain the information required by § 197.484.
(c) The report required by this section must be accompanied by a copy of the report required by § 197.41 O(a)(9) when decompression sickness is involved.
(d) The report requirt d by this section must include information relating to alcohol or drug involvement as required by § 4.05- 12 of this chapter.
(The reporting requirements in paragraph (a) was approved by OMB under control number 2 1 15-0003).
[CGD 76-009, 43 FR 53683, Nov. 16, 1978, as amended by CGD 82-023, 47 FR 35748, Aug. 16, 1982; 48 FR 43328, Sept. 23, 1983; CGD 84-099, 52 FR 47536, Dec. 14, 1987]

§ 197.488 Retention of records after casualty.

(a) The owner, agent, or other person-in-charge of a vessel or facility for which a report of casualty is made under § 197.484 shall retain all records onboard that arc maintained on the vessel or facility and those records required by this subpart for 6 months after the report of a casualty is made or until advised by the Officer-in-Charge. Marine Inspection, that records need not be maintained onboard.
(b) The records required by paragraph (a) of this section to be retained onboard include, but are not limited to, the following:
(1) All logbooks required by § 197.480.
(2) All reports required by § 197.402(a)(2)(ii), § 197.404(a)(4), § 197.410(a)(9).
(c) The owner, agent, person-in-charge. or diving supervisor shall, upon request, make the records described in this section available for examination by any Coast Guard official authorized to investigate the casualty.

Appendix A-Air No-Decompression Limits

The following table gives the depth versus bottom time limits for single, no-decompression, air dives made within any 12-hour period. The limit is the maximum bottom time in minutes that a diver can spend at that depth without requiring decompression beyond that provided by a normal ascent rate of 60 fsw per minute. (Although bottom time is concluded when ascent begins, a slower ascent rate would increase the bottom time thereby requiring decompression). An amount of nitrogen remains in the tissues of any diver after any air dive, regardless of whether the dive was a decompression or a no-decompression dive. Whenever another dive is made within a 1 2-hour period, the nitrogen remaining in the blood and body tissues of the diver must be considered when calculating his decompression.

AIR NO-DECOMPRESSION LIMITS

Depth (feet):	No-decompression knits (minutes):
35	310
40	200
50	100
60	60
70	50
80	40
90	30
100	25
110	20
120	15
130	10

(Source: U.S. Navy Diving Manual, 1 September 1973).

PARTS 198-199-[RESERVED}