

# *Industry Standard Abalone Diving*

2005

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Version (Z)  
Please refer to the attachment for detail of the introduction  
and list of participatory members.*

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***NOTE***

Occupational Health and Safety Solutions have prepared this document. The views expressed in this document reflect the collective inputs of Abalone Divers from Victoria are not to be construed in any other context, bearing or fact. © 2004/5 OH&S Solutions – Author - F. Zeigler

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14 Townsend Street, Portland Vic 3305 - ☎ (03) 5523 6392 📧 (03) 5521 7255  
frankzeigler@profdivers.com

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## Section 1 - Introduction

### 1.1 Title

This document may be cited as the *Industry Standard for Abalone Diving* (the document).

#### 1.1.1 Purpose

The purpose of this document is to provide practical guidance for diving work conducted in association with abalone diving. It is acknowledged that in all activities conducted in workplaces there are inherent dangers and abalone diving is no exception. In the development of this document, the Abalone Industry accepts that those risks are best controlled by a proactive approach to diving safety and they cannot just rely on their low incident rate, which has existed thus far. In so doing, the Industry feels that by coming together as an Industry, working together to identify the risks, and proactively and cooperatively producing a broad document based on and related to realistic risk reduction management principles will enable the sector to sustain and improve its productivity well into the future.

#### 1.1.2 Scope

This document applies to underwater operations involving compressed air and Nitrox gas breathing medium conducted in, or associated with, the Abalone Diving Industry in Victoria. Diving operations performed in accordance with this document are limited to a depth of water not exceeding 30 metres. For diving to depths greater than 30 metres or using other mixtures of gas other than Nitrox or air, special precautions must be taken in addition to those specified in this document.

The document applies to underwater diving operations using surface supplied underwater breathing apparatus (SSUBA). Due to the risk of entrapment, entanglement and inability to communicate with the surface, this document specifically does not apply to self-contained underwater breathing apparatus (SCUBA) for harvesting fish.

This document includes minimum requirements for personnel, procedures to be followed in diving, the equipment utilized, together with appendices specifically dealing with the following subjects –

- Example of Medical standards and examination reports
- Minimum qualifications for divers
- Example of Personal records and medical examinations
- Example of lifeline signals
- Example of access licence holder's record of dives

These and other references may be accessed through Australian Standards.

### **1.1.3 Industry position statement**

#### **Reference documents**

##### **AS**

- 1210 SAA Unfired Pressure Vessels Industry.
- 1269 Acoustics – Hearing conservation.
- 1337 Eye Protectors for industrial applications.
- 1885 Measurement of Occupational Health and Safety Performance.
- 1885.1 Part 1; National Standards for workplace injury and disease recording.
- 1944 Medical gas cylinder identification.
- 2030 SAA Gas cylinders Industry
- 2030.1 Part 1; Cylinders for compressed gases other than acetylene.
- 2705 Portable cylinders for SCUBA – Safety Guide.
- 2815 Training and certification of occupational divers.
- 2815.1 Part 1. SCUBA diving to 30 metres.
- 2815.2 Part 2. Air diving to 30 metres.
- 2815.3 Part 3. Air diving to 50 metres.
- 2815.4 Part 4. Bell diving.
- 3000 SAA Wiring Rules
- 4005 Training and certification of recreational divers
- 4005.1 Part1. Minimum entry-level SCUBA diving

##### **ISO**

- 2230 Vulcanised rubber – guide to storage.

##### **ANSI/ASME**

Boiler and Pressure Vessel Industry

##### **Victorian State Legislation**

OH&S Act Victoria 1985

OH&S Plant Regulations 1995

Marine Act 1988

Seafood Safety Act 2003

Occupational Health & Safety (Incident Notification) Regulations 1977

International Regulations for Preventing Collisions at Sea (1972)

## Definitions

For the purposes of this Industry document, the following definitions shall apply:

1. **Abalone diver** – a person who dives for abalone, harvests abalone or recovers abalone in accordance with the legislative requirements of the Fisheries Act 1995, as part of an occupation.
2. **Access Licence Holder** – a holder of an access licence issued under section 38 of the Fisheries Act 1995.
3. **Bottom time (BT)** the total elapsed time from when the diver leaves the surface to the time (next whole minute) that the diver begins the ascent, measured in minutes.
4. **Breathing tubes** – tubes or hoses attached to a regulator that are designed to” –
  - a) Supply air or gas to the diver;
  - b) Carry away expired gas; and
  - c) Operate at near ambient pressure.
5. **Compression chamber** (recompression chamber) - a surface chamber in which persons may be subjected to pressures equivalent to or greater than those experienced whilst underwater, or under conditions, which simulate those, experienced on an actual dive. For the purposes of this document, ‘compression chamber’ is taken to mean and include ‘recompression chamber’.
6. **Deck hand** – a person or persons, who are responsible for the supervision of the vessel, the diver and collection, measurement and containment of abalone catch including the use of all safety equipment, supporting, recovering and attending the diver and initiate and operate all safety procedures should the cause arise.
7. **Decompression schedule** - a specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table; it is normally described as maximum depth (MSW)/bottom time (minutes).
8. **Decompression sickness** (bends) - the development, during or after diving, of any abnormality, which is a direct result of a reduction in the tension of inert and other gases dissolved in the body, with the production of gas bubbles. Any organ or tissue may be involved and its presentation can vary from the acute to the chronic.
9. **Decompression stop** – the specific length of time, which a diver must spend at a specified depth to allow for the elimination of sufficient inert gas from the body to allow the diver to safely ascend to the next decompression stop or the surface.
10. **Dive control position** – a single designated position, which is adjacent to where the diver enters the water and from which a diving supervisor can monitor and supervise all systems and functions, which relate to life support and the safety of the diver in the water.

11. **Divers' hose** – a single length of an approved type of hose for breathing gas, which carries gas from the surface to the diver.
12. **Diver** – a person, approved in writing by an employer, with the appropriate skills and experience and/or trained in accordance with the appropriate sections of AS 2815, which would apply to abalone diving. (**Note** no standard of training applies for abalone diving at the time this document was written). Refer to clause 2.2.1.
13. **Dive plan** – the procedure by which this document and any additional precautions are implemented for a particular diving operation.
14. **Dive site** – refers to the underwater location where work is performed and any surface zone used to tend or supervise the diver.
15. **Diving work** – work in which diving is conducted using underwater breathing apparatus, including work by the dive team in direct support of the diver
16. **Limiting line** - a line shown on the decompression tables, which indicates time limits (bottom times) beyond which decompression schedules or exposures are deemed less safe. Diving for periods indicated below the limiting line carries a greater risk of decompression sickness, and this risk increases with time increase.
17. **Marine Safety Victoria** – the statutory body responsible for the enforcement of the Marine Act and the survey and approval of commercial vessels and water craft in the State of Victoria.
18. **Nitrox** - a mixture of oxygen gas and nitrogen gas, together which contain not less than 21% oxygen and the balance of nitrogen.
19. **Occupational diving** – diving performed in the course of employment; irrespective of whether or not diving is the principal function of employment or merely an adjunct to it. Occupational diving comprises all diving carried out as a part of a business, a service, for research, or for profit.
20. **Quick release** – able to be immediately released from the secured position by the single operation of one hand.
21. **Residual nitrogen** – nitrogen that is still dissolved in a diver's tissues after the diver has surfaced.
22. **Saturation** – that condition where the person's body tissues are totally saturated with the particular inert element of the breathing gas or medium.
23. **Supervisor** – a person appointed in writing to supervise dive operations, who is competent to do so and is trained in and current in the recognition of diving emergencies and the administration of first aid.
24. **Surface interval (SI)** – the time, which a diver has spent on the surface following a dive; beginning as soon as the diver surfaces and ending as soon as the diver commences the next descent.

25. **Surface Supplied Underwater Breathing Apparatus (SSUBA)** – diving equipment, which supplies the wearer with compressed gas suitable for the depth of the dive through a hose from a compressor or storage cylinders, located at the surface.
26. **Therapeutic recompression tables** – tables used for the treatment of decompression sickness and other pressure-related injuries.
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## Section 2 – Personnel for Diving Operations

### **2.1.1 Supervisor**

At all times whilst a diver is in the water or under pressure, there shall be present at all times a supervisor.

### **2.1.2 Qualifications of supervisors**

A supervisor shall be –

- (a) A trained, experienced person who has experience or knowledge of the diving techniques which may be required to be used and in the use of the equipment and procedures used in the diving operations;
- (b) Recorded as being the supervisor; and
- (c) Competent to safely carry out the duties of the supervisor.

### **2.1.3 Duties of supervisors**

A supervisor shall ensure that all diving operations under supervision are carried out in accordance with this Industry Standard and shall be familiar with any statutory regulations and guidelines, which may be applicable to the operations.

The abalone Industry operates with 2 man dive teams with dual and alternative supervisory roles, which require both the diver and deckhand to plan the diving operation for the diving day.

The dive planning shall include such things as safety, location, depths, and times, catch rates etc and the specification of responsibilities in accordance with Section 3.

The diver is responsible at all times for all aspects of the dive operation over which he or she has immediate or direct control.

Other than when the diver is in control, the deckhand shall be responsible for the safe operation of the vessel, machinery and dive equipment including the diver over matters, which are not within the diver's control. The deckhand shall abort diving operations where conditions exceed his or her ability to maintain the safety of him or herself, the vessel or the diver.

## **2.2 Diver**

2.2.1 No person shall employ, instruct or allow any person to act as diver, and no dive shall be carried out, unless the diver is –

- (a) At least 18 years of age; and
- (b) Has been certified as medically fit to dive in accordance with the requirements of “**Appendix A**” by a medical practitioner experienced in underwater medicine; and
- (c) Is competent to safely carry out the work required in the operation; and

- (d) Has been trained in diving and in the use of equipment used in diving operations to the qualifications and competencies as approved by the Abalone Industry as per “**Appendix H**”; or
- (e) Or has completed 40 days as a licenced commercial abalone diver, within any state of Australia prior to the adoption of this document.

### **2.3 Deck hand/Divers attendant**

Whenever a diver goes underwater or is subjected to pressure, the diver shall be attended by a deck hand/diver’s attendant who shall be 18 years of age or over and have a working knowledge of the following:

- (a) This Industry;
- (b) The requirements of underwater work;
- (c) Signals in use;
- (d) Decompression procedures;
- (e) Diving plant and equipment in use, including ancillary fittings such as pressure gauges, compressors, filters, high pressure and medium pressure gas systems; and
- (f) First aid, including expired air resuscitation, external cardiac compressions, operation of oxygen administration equipment and first aid treatment of diving illnesses.

The deck hand/divers attendant shall not be engaged in any other task, which may affect their ability to apply complete attention to the safety of the diver. Other tasks may be undertaken, depending on the abilities of the individual, such a measuring abalone, however the care of the diver has the absolute priority in every case.

**NOTE** - the supervisor may also perform the task of deck hand/diver’s attendant where all appropriate qualifications, abilities and attributes are met.

### **2.4 Standby diver**

Except as provided for below, whenever a diver is underwater, a standby diver shall be present on the surface. The diver shall be medically fit, qualified to dive and dressed to the extent that the diver can enter the water almost immediately to go to the aid of the distressed diver. The standby diver may also perform duties, which do not prejudice the safety of the diver in the water.

Clause 2.4 may not apply where:

- (a) The diver has a clear vertical ascent to the surface at all times and not impeded by solid or hard material;
- (b) The deck hand/diver’s attendant can recover the diver at all times without the need for any person or diver to enter the water;
- (c) A unaided practice rescue of the diver has been successfully undertaken;
- (d) The depth of water is less than 30 metres;
- (e) The diver is appropriately connected to the breathing hose by a means which does not allow a quick release without two independent means of disconnection of the hose assembly;

- (f) The diver has an independent supply of breathing gas if diving below 2 metres water depth, sufficient to allow an ascent to the surface within an acceptable ascent rate plus a reserve of gas of at least 50%; and
- (g) Proper signal contact between the diver and the deck hand/diver's attendant is available, tested and maintained at all times.

## **2.5 Supervision of health**

- 2.5.1 No person shall dive or be subjected to pressure unless that person has been examined and certified as fit in accordance with “**Appendix A**” by a medical practitioner within a minimum of 24 months prior to diving.
- 2.5.2 An increase in the frequency of examinations in individual cases is at the discretion of the medical practitioner.
- 2.5.3 Diving should not be undertaken if the diver is taking any medication of any type, prescription or non-prescription drugs, including marijuana, without the advice of an appropriate medical practitioner; or within 8 hours of consuming any intoxicants.

## **2.6 Records**

- 1) Every diver shall keep a log or log book, which shall be a record of all dives, depths and times of dives.
- 2) These shall be entered into the log or logbook at the completion of each working day along with a brief summary of any incidents and accidents.
- 3) Each entry should be signed by the diver and countersigned by the diving supervisor, with verification by a stamp.
- 4) This log or a copy of the log should be presented at each medical examination and be available on site.
- 5) A record of all medical examinations should be contained in the same logbook.
- 6) The logbook may be bound or loose-leaf, however in all cases each page shall be numbered consecutively.
- 7) Fishing catch records, together with the above details may be used as the diver's record provided a separate copy has been made and kept appropriately.

Maintenance record – where tests are carried out; e.g. air purity, records of test results, together with identification of the compressor, shall be maintained for the life of the compressor and kept for five years.

## Section 3 - General procedures for diving

### **3.1 Organization & planning**

- 3.1.1 Diving needs planning and foresight; integration of consideration of hazard and risk assessments to enable divers safety and bottom time is kept at a premium. The diver must be placed on the bottom in a position to make the most of safety, high yield capture rates, and ability to get on with the task knowing that the surface is looking after all the interests of the diver at all times.
- 3.1.2 Failure to consider any item of available information during the planning stage may jeopardize the life of the diver or result in a failure of the diving operation.
- 3.1.3 Time spent in determining conditions under which the diver will work will result in greater efficiency once the work is commenced.
- 3.1.4 For commonly performed tasks, basic dive plans and checklists should be incorporated in the operations manual.
- 3.1.5 Good diving practice should be followed at all times, such as deepest dives first with all subsequent dives shallower, reduction of the potential incidences of decompression and other diving or non-diving injury/s must have the highest priority.
- 3.1.6 Consideration must be given to reducing the accumulated effects of repeated diving exposures and extra precautions such as programmed breaks, use of specialised gas mixtures and other matters.

### **3.2 Surface conditions**

- 3.2.1 Diving operations shall not be conducted in rough seas, unusual tides or currents, or other adverse conditions unless the supervisor and the diver consider that the diver's safety will not be jeopardised.
- 3.2.2 Should adverse conditions develop whilst the dive is underway, consideration should be given to aborting the dive.
- 3.2.3 Conditions include the state of the sea, weather, visibility, tide, currents, and water temperature, presence of other ships or other craft and any other surface conditions, which could affect the operation.

### **3.3 Depth of water**

Before diving operations are commenced at any location or site –

- 3.3.1 The depth of water shall be ascertained by reliable means; and
- 3.3.2 The maximum depth shall be taken into account in the planning of the dive.

### **3.4 Communications**

There shall be a reliable means of communication between the diver and the surface. It should be by –

- 3.4.1 Reliable audio communication; or
- 3.4.2 A hose or lifeline with an established signalling system; or
- 3.4.3 Any other system that results in the diving operation having a level of safety not less than provided by systems incorporating items 3.4.1 or 3.4.2 above.

**NOTE** - As abalone recovery involves the use of lift bags from the diver to the surface, experience within the industry considers such use a low risk activity and the use of voice communications is optional.

### **3.5 Water temperatures**

The temperature of the water at the dive site shall be ascertained and the diver shall be supplied with appropriate equipment to ensure the diver is maintained at a safe temperature, sustainable for the comfort and safety of the diver.

### **3.6 Plant and equipment – General**

- (a) The diver, deck hand/diver's attendant and supervisor shall know the capabilities and limitations of any equipment they use.
- (b) Plant and equipment shall not be altered, modified or changed in any way that might impair the safe and efficient operation of the equipment.
- (c) Plant and equipment shall comply with the relevant requirements of sections 4, 5 and 6 of this Industry.
- (d) Reduction of manual handling shall be incorporated wherever possible.
- (e) The supervisor shall ensure that both the type and capacity of the plant and equipment are suitable for the job, and that the equipment is properly maintained and serviced to the supplier's standards and regulations, and that it is kept in a safe working condition.

### **3.7 Inspection**

In addition to the above –

- (a) The supervisor and diver shall personally inspect and check equipment to ensure it is working efficiently before each dive commences;
- (b) Pre-dive equipment checks detailing essential items may be recorded in the diving operations manual and where systems are complex a point-by-point checklist may be used to ensure physical compliance is maintained.
- (c) No person shall require a diver to use any part of any plant or equipment if it can be demonstrated that such plant or equipment is not in a safe working condition.
- (d) Where dive systems are designed in such a way to record visual confirmation of compliance of operation, a pre-dive checklist will be optional.

### **3.8 Maintenance & servicing**

The following requirements apply to the maintenance of diving equipment –

- (a) All underwater equipment shall be cleaned with fresh water, drained and dried before being stored in accordance with clause 3.9. Where appropriate, equipment such as full-face masks should be thoroughly cleaned by using a suitable anti-viral and anti-bacterial disinfectant. Care should be taken to ensure that when selecting disinfectants they are compatible with the materials being cleaned;
- (b) All diving equipment shall be maintained in good and safe condition and in efficient and effective working order;
- (c) Every gauge, which is used for measurement of the diver's depth shall be checked at intervals not exceeding three months and if, found to be in error, adjusted to read correctly, or suitably marked, tagged and logged to show the amount of error;
- (d) Where vessels use pre-measured lines for depth confirmation the gauge calibration period shall be set at intervals not exceeding 12 months; and
- (e) All maintenance shall be in accordance with the manufacturer's instructions.

### **3.9 Storage**

All diving equipment, when not in use or required for immediate use shall be stored in a room or locker not used for the storage of any other goods or materials which may be detrimental to diving equipment.

### **3.10 Medical and Treatment Equipment**

3.10.1 The Industry of Practice for First Aid in the Workplace provides advice for the contents of first aid kits. In addition the first aid kit as specified for vessels in fishing survey under the Marine Act, shall be complied with. In addition to these general provisions, the following are needed for all dive operations:

- (a) A device which can enable 100% oxygen by mask or mouthpiece to a patient who is breathing spontaneously;
- (b) A sufficient oxygen supply, taking into account the location of the dive site and access to medical facilities; and
- (c) Bandages and dressings suitable for arresting major bleeding and scissors or shears suitable for cutting diving suit material;

### **3.11 Emergency procedures**

The emergency procedures in use in the abalone diving industry will vary from location to location, however immediate first aid and the ability to communicate to a primary health care facility is essential. When an emergency is declared every effort shall be made to ensure swift and timely transport of a patient is consistent with sea state conditions, the nature of the incident or injury and any other mitigating factors.

### **3.12 Diving vessel requirements**

#### **3.12.1 Vessels used for abalone diving**

Abalone diving shall be conducted from a vessel that –

- (a) Is safe and suitable for the purpose;
- (b) Complies with all provisions as required by registration and compliance with the Marine Act;
- (c) Enables the equipment necessary for the diving operations to be transported and stored;
- (d) Has a suitable means by which the diver can enter and exit the water; and
- (e) Has a means to recover an injured diver from the water.

#### **3.12.2**

Diving shall not be conducted from a vessel underway unless adequate precautions, or other such proper means or methods are undertaken, and shall only be conducted when the conditions are safe to do so.

### **3.13 Signals**

When diving from a vessel, the International Regulations for Preventing Collisions at Sea (1972) or local harbour rules shall apply. A dive flag, Industry “A” shall be flown at all times divers are about to enter, are in or are exiting the water.

### **3.14 Communications equipment**

Adequate vessel to vessel and vessel to shore communication facilities shall be provided to cater for emergencies.

### **3.15 Decompression Tables**

The proper and timely use of decompression procedures in dive planning involves a number of systems, equipment and tables. It is not the scope of this section of the Industry to delve into great detail of the tables other than to enforce the need for compliance with the provisions of use of suitable decompression tables. Therefore the general principles shall be applied in the Industry. For specific details of the decompression tables, reference should be made to AS 2299 and AS 2815. It is accepted that even when proper decompression procedures are correctly applied there remains a risk of decompression sickness.

The age of the diver, level of exertion, water temperature, personal fitness and physical characteristics, individual factors on the day, depth, time spent at depth, surface interval, temperature and other factors all meld into considerations of susceptibility for decompression sickness (DCS) and other diving conditions should be taken into account when planning diving, operating and identifying hazards and applying proper control systems and methods. In the consideration of reducing the possibility of DCS this Industry encourages the use of all approved tables and especially the use of dive computers.

### 3.16 Generic terms

#### 3.16.1 Dive planning

- 3.16.1 All diving shall be undertaken using recognised decompression procedures and is to be planned to minimise the risk of decompression sickness and other diving medical considerations.
- 3.16.2 In planning diving operations all necessary steps must be taken to identify those risks and adequately address those factors, i.e., cold water – provide adequate thermal protection or reduce bottom times; hard work in arduous conditions, reduce exposure or bottom times.
- 3.16.3 Dives shall be planned so that-
- (a) The deepest dive is always conducted first;
  - (b) All subsequent dives are progressively shallower; and
  - (c) No dive is followed by a deeper exposure at any time during one working day; and
  - (d) Where tables are used which involve a limiting line for depths and exposures, these are to be considered.

### **3.17 Decompression diving**

No dive shall be planned so as to require a mandatory decompression stop.

### **3.18 Table variations**

Dives beyond the 30-metre depth is not covered by this Industry. Conservative exposures (reduced times and depths) are highly encouraged to be adopted wherever possible.

### **3.19 Hot showers**

Hot showers are to be avoided immediately after diving as this can increase the incidence of DCS; warm showers are however encouraged to assist divers return to a warmer temperature after cold-water exposure dives.

### **3.20 Alcohol and drug consumption**

No alcohol is to be consumed within 8 hours before diving or for 2 hours following diving. Each member of the dive team, shall so far as is reasonable, ensure that he or she is not affected by the consumption of alcohol or drug, or in such a state as to endanger his or her own health or safety at work or the health and safety of another person.

### **3.21 Lifeline**

Where required, the form and connection of a lifeline shall comply with one of the following:

- (a) A separate line constructed of cordage with a safe working load of not less than 4.5 kN and with a diameter of not less than 8-mm;
- (b) A combined communication line and lifeline complying with item (a) above; and
- (c) The surface-supply air hose and its attachment to the harness or diver support device.

### **3.21 Gas breathing apparatus design and construction**

Air and gas breathing diving apparatus shall be designed and constructed from non-toxic corrosion-resistant materials, and shall-

- (a) Provide the wearer with respirable gas at a pressure and volumetric flow rate at all times during the effective life of the apparatus;
- (b) Prevent the ingress of water into the breathing circuit;
- (c) Prevent leakage from the breathing circuit except through the exhaust valve(s);
- (d) Ensure that couplings provide a secure and gas tight joint and that when such couplings are detached, any sealing washers are retained in position;
- (e) Ensure that component parts likely to require maintenance are readily detachable without risk of accidental disconnection;
- (f) Not unduly impede the wearer when swimming and working underwater; and
- (g) Ensure that the method of fastening the equipment to the wearer is secure in action and may permit quick release in an emergency.

### **3.22 Requirements for component parts**

- (a) General material, which may come in contact with the skin, shall be non-staining, soft, pliable and not likely to cause skin irritation.
- (b) Unless otherwise specified by the manufacturer, each component part of the breathing apparatus shall have a storage life of at least five (5) years when properly stored and maintained.

### **3.23 Face masks or helmets<sup>1</sup>**

Masks and helmets shall be designed and constructed so as to-

- (a) Provide a watertight and gas tight seal;
- (b) Enable all component parts to withstand, without failure or displacement, a pressure of 15 kPa above or below ambient pressure;
- (c) Cause the least possible interference with vision;
- (d) Minimise the build up of carbon dioxide gas (CO<sub>2</sub>);
- (e) Be purge able of water; and
- (f) For full face masks and helmets, incorporate a valve to prevent the ingress of moisture into the breathing circuit.

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<sup>1</sup> There is no standard for the construction of underwater masks or helmets, however performance of such equipment is covered in AS1516/1517 and is cited as the minimum criteria to be applied in this document.

A full-face mask shall cover the eyes, nose and mouth and include a facility for ear clearing. The mask shall be secured in position by means of a head harness or may form part of a helmet supported on the wearer's head or shoulders by suitable means.

The safety faceplate shall be capable of meeting the impact test for eye protectors as specified in AS 1337.

Head harness and safety strap shall be of webbing, strip rubber or other suitable material, which shall not be less than 15-mm wide. Provision shall be made to prevent the slipping of the adjustment buckles when the harness straps are wet.

### **3.24 Mouthpiece or demand valve**

Where a mouthpiece is incorporated into the breathing system, it shall be designed to meet the following requirements-

- (a) Provide a watertight and gas tight seal when held firmly and without undue discomfort in the wearer's mouth;
- (b) Prevent closure of the aperture of the mouthpiece by normal mouth pressure; and
- (c) Include a flange to be held between the lips and the teeth to facilitate a watertight and gas tight, and lugs to be held between the teeth to prevent the mouthpiece from slipping from the wearer's mouth.

### **3.25 Diver's hose**

Hose for use in diving shall be of one continuous length, designed specifically for the conditions experienced in such use, shall be manufactured, maintained and tested in accordance with the following-

- (a) A hose shall not be used in diving operations for conveyance of the breathing medium at a pressure exceeding one quarter of the burst pressure as specified in item (b);
- (b) The burst pressure shall be defined as the pressure at which that hose, or another hose similar to it in all respects, has burst when tested to the maximum operating temperature;
- (c) A hose assembly shall not be used in diving operations for the conveyance of the breathing medium unless –
  - (1) It has been tested not more than 12 months prior to those operations to 1.5 times its maximum operating pressure;
  - (2) It has a minimum internal diameter of 8-mm and is kink resistant;
  - (3) Where wear or damage is identified or subjected to frequent or harsh use conditions more frequent testing might be required;
  - (4) It is capable of carrying the breathing medium at a flow rate required in the operations considering the maximum operating depth and the level of exertion without causing any discomfort or difficulty in breathing;
  - (5) The hose and its couplings and fittings are in alignment;
  - (6) The couplings and fittings are not scoured or substantially corroded;
  - (7) The couplings and fittings contain no damaged threads;

- (8) The hose fittings are made of brass, stainless steel, Monel metal or other non-corrosive material;
- (9) The fittings connecting the hose to the diving equipment are incapable of accidental disengagement or loosening; and
- (10) It is, where practicable, of such diameter and has such type of connection as will ensure the possibility of wrongly connected hoses and fittings.

### **3.26 Inlet and exhaust valves**

Valves shall be designed and constructed so that –

- (a) Any leakages will not exceed .03l/min when tested with air at a constant suction head of 35-mm water. The valve and its seat may be wet for this test;
- (b) Adequate protection from mechanical damage;
- (c) Capable of easy maintenance;
- (d) They are fitted in, or as close as is practicable to, the full face mask or mouthpiece;
- (e) They will not be affected by any heat or moisture to which they are likely to be exposed while stored or in use; and
- (f) Where manually operated, they are easily located and operated whilst wearing the appropriate hand or body protection.
- (g) The resistance to a continuous stream of air through the valve assembly shall not exceed –
  - a. 19-mm water when the air flow is 85L/min; and
  - b. 57-mm water when the airflow is 170 L/min.

The foregoing requirements apply to the whole of the valve assembly including all the parts through which the gas passes. Where a valve is duplicated in the apparatus, the requirements apply to the valves in combination and not to each valve separately.

### **3.27 Demand air supply device**

The demand air supply device shall consist of a pressure-reducing system and means of exhausting excess gas pressure from the breathing circuit. The design shall be such that the device is adequately protected against damage and its efficiency is not impaired by any heat variations or moisture likely to be countered in use

### **3.28 Cylinders**

- (a) Cylinders for compressed air shall comply with the specifications listed in AS 2030.1 or AS 2715 as appropriate.
- (b) Where cylinders contain air they shall be durably marked with the word **AIR** in letters not less than 50-mm high. The word **AIR** shall be in a contrasting colour to the body of the cylinder or the cylinder shall be colour coded in accordance with AS 1944.
- (c) Where cylinders contain Nitrox they shall be durably marked with the word **NITROX** in letters not less than 50-mm high. The word **NITROX** shall be in a contrasting colour to the body of the cylinder or the cylinder shall be colour coded in accordance with AS 1944.

- (d) Nitrox shall always be indicated by the oxygen concentration first and the nitrogen concentration second. For example, Nitrox 32 refers to 32% oxygen in nitrogen; *Nitrox 40* refers to 40% oxygen in nitrogen.
- (e) Cylinders for underwater use shall be inspected and tested at intervals not exceeding one year (1) in accordance with AS 1337.
- (f) Portable cylinders for compressed gases (over 10-bar working pressure) not immersed or used at any time underwater shall be tested at intervals not exceeding five years (5) in accordance with AS 1337.
- (g) Stationary cylinders for compressed gases for high-pressure applications shall be tested at intervals not exceeding ten years (10).
- (h) All other pressure vessels shall be tested or inspected at intervals not exceeding those specified and in accordance with AS 3788.

### **3.29 Diving suit or dress**

Diving suits and other diving dress shall be a suitable fit and designed to maintain the diver at a comfortable temperature during diving operations.

Where constant volume suits are to be worn with an inert inflation system the inflation system for the suit shall –

- (a) Be completely independent to the breathing gas mixture;
- (b) Not be interchangeable with the connections on the breathing gas;
- (c) Contained within cylinder(s) labelled with the gas such as “*ARGON*” in letters at least 50-mm high in a colour, which is in contrast to the cylinder colour; or the cylinder, shall be colour coded in accordance with AS 1944; and
- (d) The fitting of ankle valves, which allow the release of gas from the suit at each ankle, shall be of a type suitable for the depth of water being dived.

### **3.30 Weight belt or weights**

- (a) Any weights or weight belt worn by the diver shall be fitted with a reliable release mechanism which cannot be accidentally released, but which can be readily operated by the diver underwater.
- (b) Weights and weight belts shall be worn in such a manner that when released, they will not foul any other piece of the diver’s equipment. In addition, the weights shall be attached in such a manner as to not slide and foul the release mechanism.

### **3.31 Diver’s knife/abalone tool**

- (a) Every diver shall carry a knife or underwater tool at all times when engaged in a diving operation underwater.
- (b) The tool shall be worn or tethered in such a position that it will not foul any discarded equipment, for example, released weights.
- (c) The tool shall also comply with all regulations under the Fisheries Act.

### **3.32 Gas supplies**

Diving in the abalone industry is by its very nature of a seasonal nature and in some cases only 25 days diving may be conducted within any one season. With some divers, up to 60 days diving may be conducted as a maximum each season. The compressor and filter systems are therefore relatively little used when compared to other commercial diving operations. As air purity is of the utmost consideration the Industry specifies a clear understanding and interpretation of air purity.

### **3.33 Air**

Air used in diving work shall –

- (a) Have no objectionable or nauseous odour;
- (b) Contain not less than 20% and not more than 22% by volume of oxygen;
- (c) Contain not more than 11mg/m<sup>3</sup> of carbon monoxide at 15°C and 100 kPa (10 ppm by volume);
- (d) Contain not more than 900 mg/m<sup>3</sup> of carbon dioxide at 15°C and 100 kPa (480 ppm by volume);
- (e) For high pressure cylinders, contain not more than 100mg/m<sup>3</sup> of water at 15°C and 100 kPa (130 ppm by volume);
- (f) Contain not more than 1 mg/m<sup>3</sup> of oil at 15°C and 100 kPa when sampled from a cylinder filled to a pressure of at least 12 MPa;
- (g) Where supplied from a compressor, not be used for diving operations unless the compressor has, within the twelve month period preceding the operations as appropriate, undergone a test to ensure that the compressed air satisfies the items in (a) to (f) above inclusive; and
- (h) For all air testing equipment, the manufacturer's instructions shall be strictly followed and complied with.

Additional requirements for compressor air supplies are specified in Section 5.

### **3.34 Nitrox**

Nitrox used in diving work shall –

- a) Use only oxygen gas which is supplied as Medical grade; or
- b) Use only oxygen gas which is supplied from a membrane;
- c) Where (b) above is utilised, the oxygen must be analysed prior to being boosted or filled in compressed gas cylinders;
- d) Only be filled or decanted into cylinders which have been specially cleaned or are suitable for oxygen service by a suitably qualified person;
- e) Analysed for oxygen concentration before being permitted to leave the mixing or filling station;
- f) Labelled at the time the mixing or blending was conducted before being moved or loaded;
- g) Labelled with the oxygen concentration which is analysed, and contain on the label the following -
  - 1) The date the mix was blended;

- 2) The maximum operating depth; (according to NOAA tables)<sup>2</sup>
  - 3) The oxygen concentration of the mixture;
  - 4) The name of the blender; and
  - 5) The filling pressure and or the reference temperature.
- h) Only use Nitrox which is within 1% of the stated oxygen concentration value; and
  - i) Where cylinders contain Nitrox they shall be durably marked with the word **NITROX** in letters not less than 50-mm high. The word **NITROX** shall be in a contrasting colour to the body of the cylinder or the cylinder shall be colour coded in accordance with AS 1944.

### **3.35 Pressure gauges**

Abalone diving occurs in waters, which are subject to wave and surge influences with frequent alterations in depth occurring. It is for this reason that robust and practical gauges of either digital or analogue reading are to be considered for use. Ideally a recording digital gauge offers the best record of depth and time exposures.

A gauge used in, or in connection with, diving operations shall –

- (a) If used to measure the depth of the diver be calibrated either in feet head of sea water (showing clearly each two feet) or metres head sea water (showing clearly each half metre);
- (b) If used to measure the depth of the diver, the gauge is to be checked against a master test gauge upon arrival at site or at least once in each period of twelve months and whenever it appears to be incorrect;
  - 1) If it is a master gauge, be calibrated once in each twelve months by test; and
  - 2) If it is a deadweight tester, be verified in accordance with the Weights and Measures (National Standards) Act 1960 – 1966 of the Commonwealth of Australia, or by a deadweight tester of gauges for which an endorsed test certificate is currently in effect;
- (c) Where either (b) 1) or (b) 2) above is inappropriate, the diver may use two independent gauges, and shall compare the two gauges and take the deeper reading of the two in determining depth.
- (d) Where any doubt exists as to the reading or accuracy of any gauge the gauge shall be withdrawn from service and sent for calibration check and adjustment where necessary.

### **3.36 Gauge accuracy**

A gauge used for diving operations –

- (a) For measuring depths less than 30 metres, shall have to be within 1% of the maximum scale reading;
- (b) With a maximum scale reading not exceeding 200m for measuring depths exceeding 30m and less than 200m, shall have an accuracy within 0.5% of the maximum scale reading; and
- (c) In any other case, shall be accurate to within 2.5% of the actual condition it is measuring.

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<sup>2</sup> NOAA – refers to the National Oceanic and Atmospheric Administration - USA

### 3.37 Emergency air or breathing gas supplies

Emergency air or breathing gas supplies shall be of sufficient capacity for the diver to return to the surface with a reserve of at least 50% and such supplies shall be independent from the main breathing supply. The depth of water and any decompression requirements shall be taken into consideration when determining the amount of reserve breathing gas.

### 3.38 Diving before or after air travel

#### 3.38.1 Diving after travel

The diver shall have adequate rest before diving.

#### **3.38.2 Travel after diving**

Altitude exposure after diving is a potent precipitator of decompression sickness. **Table 1** should be applied to the diver after any dive with regard to air travel or road travel over mountains. In pressurised commercial aircraft, the altitude referred to is the effective altitude within the aircraft's cabin, which is usually pressurised to an effective cabin pressure of 2400 metres or less. The tables or computer being used by the supervisor and diver shall determine the requirements for flying after diving.

**Table 1** – Minimum Delay before Exposure to Altitude

<b>Minimum Delay before Exposure to Altitude</b>			
<i>Altitude (m)</i>	<i>Minimum delay before exposure to altitude (h)</i>		
	<i>Category of dive (see legend- Table 2)</i>		
	<b>1</b>	<b>2</b>	<b>3</b>
<i>0 – 150</i>	<i>Nil</i>	<i>Nil</i>	<i>2</i>
<i>150 - 300</i>	<i>Nil</i>	<i>2</i>	<i>4</i>
<i>300 - 600</i>	<i>2</i>	<i>12</i>	<i>24</i>
<i>600 - 2400</i>	<i>12</i>	<i>24</i>	<i>48</i>
<i>Greater than 2400</i>	<i>24</i>	<i>48</i>	<i>72</i>

**Table 2** – Legend for category of dive

<b>Legend</b>	<b>Detail</b>
<i>Category 1</i>	<i>Single dive to 50% of no decompression limits or repetitive dives in the previous few days</i>
<i>Category 2</i>	<i>Routine no-decompression diving; single decompression stop dives</i>
<i>Category 3</i>	<i>Multiple decompression dives or extreme exposures or omitted decompression or other adverse and/or arduous events or activities</i>

### 3.38.3 Pre and post dive activities

Hard physical activity pre-dive and post-dive may increase the risk of developing decompression sickness. It is essential that divers refrain from heavy exertion in these periods where dives are conducted to over 50% of the maximum no decompression limits or any decompression diving is being undertaken.

As a rule, the level of activities similar to those as indicated by the ACGIH<sup>3</sup> as anything over moderate as indicated by the categories in Table 3 below should be avoided.

**Table 3** – Examples of Activities within Metabolic Rates - Work Demand Categories  
(Guide only to work categories)

Categories	Example Activities
<b>Resting</b>	Sitting quietly
	Sitting with moderate arm movements
<b>Light</b>	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
<b>Moderate</b>	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on a level at 6 km/hr while carrying 3 Kg weight load
<b>Heavy</b>	Carpenter sawing by hand
	Shovelling dry sand
	Heavy assembly work on a non continuous basis
	Intermittent heavy lifting with pushing or pulling (eg., pick and shovel work)
<b>Very Heavy</b>	Shovelling wet sand

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<sup>3</sup> ACGIH – American Conference of Government Industrial Hygienists

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## Section 4 – Recompression chamber equipment

### Recompression chamber equipment and facilities

Abalone harvesting is by its very nature undertaken in relatively shallow water and relies heavily on safe water conditions conducive to harvesting. The depths and durations are ultimately weather dependant in the western zone and as such preclude long durations. Much of the underwater work is physically demanding and also limits the reasonable duration a diver can work at depths for. Over the past 4 decades the incidence rate of decompression sickness is extremely low and is testimony to the diving practices put in place to combat the potential incidence of decompression sickness.

The time of treatment, cost of treatment and loss of income are other controlling factors, which also assist, in the proper application of sensible depth and time exposures. A major study undertaken circa 1985, specifically in the western zone, by Dr Carl Edmonds of the Royal Australian Navy School of Underwater Medicine clearly proved that osteonecrosis and long term effects from exposure to pressure was not evident in long working abalone divers.

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Another view was that some divers would be inclined to extend depths and times should a hyperbaric chamber be available in an endeavour to increase yield catch rates. Since 1995 the western zone has had the availability of a twin-lock and transportable single lock recompression chambers on a 24 hour a day, seven day a week basis and these have relatively remained unused for treatments of decompression sickness.

Depths are limited to those not exceeding 30-metres with a realistic depth of diving in the 8-metre to 13-metre range as most typical with some divers working to 20 metres on occasions.

It is for these reasons that the Industry specifically does not include details on recompression chambers.

## Section 5 – Procedures for SSUBA Diving Operations

### Procedures for SSUBA Diving Operations

#### **5.1 General**

Diving operations for SSUBA shall comply with the requirements of this section in addition to the general and medical requirements of this document.

#### **5.2 Personnel required**

At every SSUBA diving operation or dive vessel there shall be sufficient personnel to ensure that diving is performed safely. The following minimum number of personnel should be present –

- (a) Dive depths to 20 metres; one supervisor, one diver and one deckhand/diver's attendant, a minimum number of two persons;
- (b) Dive depths to 30 metres; one supervisor, one diver and one deckhand/diver's attendant, a minimum number of two persons – provided that extra precautions are taken to ensure the safety of the diver; including
  - 1) Line/hose/signals are known and practiced;
  - 2) Clear vertical ascent to the surface at all times;
  - 3) Water conditions are of low current or water resistance;
  - 4) A bailout cylinder is worn with 100% spare reserve gas is provided; and
  - 5) A no decompression schedule is being dived.
- (c) In any case there shall be no less than a two-person dive team;
- (d) The supervisor may perform the role of deckhand/diver's attendant and the deckhand/diver's attendant may also perform the role of supervisor only when qualified/experienced to do so; and
- (e) There exists the possibility to increase dive crew numbers over the minimum where necessary, and where Fisheries Act compliance allows.

#### **5.3 Compliant equipment**

Equipment shall comply with the relevant requirements in Section 3 in addition to the requirements of this section.

#### **5.4 Underwater surface supply apparatus.**

For a surface supply system, the underwater equipment used shall include the following:

- (a) A surface supply hose for each diver, including a non-return valve located as close as possible to the diver, i.e. at the breathing medium inlet to the mask or mouthpiece or as an integral part of the components specified in item (b);

(b) Any one of –

- 1) A full-face mask or lightweight mask or helmet incorporating an oral/nasal mask or mouthpiece;
- 2) A half-face mask with separate mouthpiece and a optional quick release safety strap capable of holding the mouthpiece securely in the mouth; or
- 3) An incompressible helmet
- 4) Inlet and exhaust valves.
- 5) Either one or a combination of -
  - (a) A demand gas supply device; or
  - (b) A free-flow air device.
- 6) For demand breathing, breathing tubes or pressure pipe or pressure hose; and
- 7) An emergency breathing gas supply; and
- 8) A harness, buoyancy-control device or other such device to secure the gas supply hose and equipment to the diver.

## **5.5 Lifeline**

No SSUBA abalone diving operation may be conducted without the diver being secured by a lifeline or hose complying with clause 3.25 and both the diver and the deckhand/diver's attendant being thoroughly conversant with the agreed system of lifeline signals as are suitable, usable and understood by the dive team.

## **5.6 Compressed gas supply**

5.6.1 Compressed gas shall be supplied to the diver from a primary and secondary gas supply source. Each source may be either a power driven compressor or a bank of compressed gas cylinders or a combination of both. The primary gas supply and the secondary gas supply shall comply with the following:

- (a) Where air is supplied from a compressor-
  - 1) An air receiver shall be utilized;
  - 2) A non-return valve shall be fitted between the compressor and the receiver at the receiver end of the connection pipe;
  - 3) A suitable filtration system to remove all impurities shall be utilized; and
  - 4) A control system shall be utilized.
- (b) When air is supplied at a pressure exceeding 2100 kPa, the pressure shall be reduced by an adjustable reducer able to match the diver's varying gas requirements under all anticipated and real conditions. Where automatic reducers are to be used, they shall be capable of providing sufficient air to match -
  - (a) The breathing apparatus to be used;
  - (b) Extended hose lengths at shallow depths; and
  - (c) Increased air consumption due to physical exertion.
- (c) The air intakes of air compressors used to supply air to divers shall be so placed that the air supplied is not contaminated by engine gases, or by any dust fumes, gases or other substances that may be detrimental to the health or comfort of the diver.

- (a) Reducers must be of a type, which are not prone to freezing in high or any flow characteristics; and
- (b) Reducers must have a line pressure indicating gauge to enable reading of the intermediate line pressure at all times.

### **5.6.2 Working pressure**

1. The pressure required to be delivered to the diver's breathing apparatus will depend on the type and depth of the dive.
2. For rigid helmet diving the pressure of the air shall be not less than 350 kPa or the divers working depth in metres multiplied by 15 kPa, whichever is the greater. In any respect the diver shall at no stage have any difficulty whatsoever in breathing or respiratory discomfort whilst on the surface or underwater.
3. Where a demand surface supply device is used, the minimum gauge pressure shall be 700 kPa plus 10 kPa for every metre of the diver's working depth.
4. The value of 10 kPa does not make allowances for the effects of increased pressure and air density or the frictional losses of the hose. It is a guide only.

### **5.7 Secondary air or gas supply**

For all surface-supplied diving there shall be secondary supply of air or gas that will enable the diver to be brought back to the surface, making due allowance for a decompression schedule if this is applicable, should the primary source fail. Suitable forms of secondary supply are as follows:

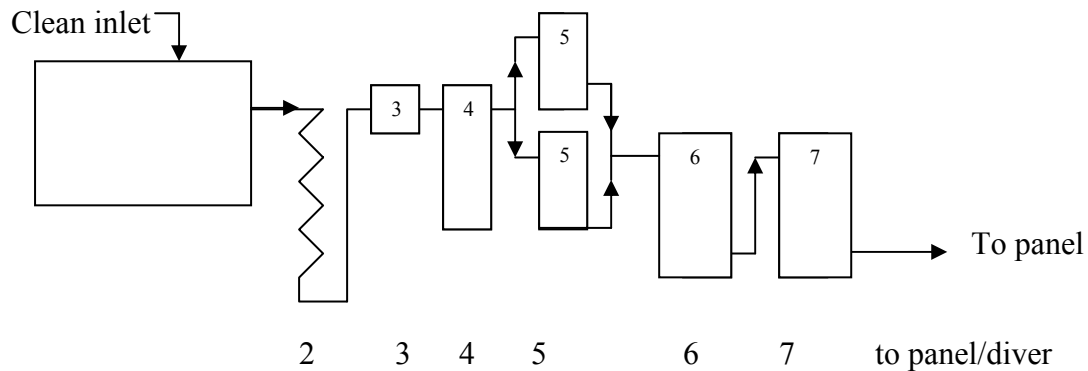
- (a) High pressure air reservoirs attached to the diving control station fitted with the appropriate pressure reduction stages;
- (b) Where different gas mixes are used, each mix and system shall have an independent supply available so as to not alter the diver's breathing mixture, or decompression profile, during changeover of breathing medium or in an emergency.
- (c) Additional primary units attached to the system as standby units. Such secondary units shall be maintained connected and fully operational to the primary system at all times; and
- (d) Emergency gas supplies worn by the diver shall not be used as a secondary gas supply.

### **5.8 Air compressor systems**

#### **General**

Power driven compressor systems used for diving operations shall be of a type that will provide air of a purity complying with clause 3.33. Air shall be delivered via a suitable receiver and cooling/drying/filtration system to ensure such purity.

**Figure 4** – a typical compressor system for respiratory quality air.



**Legend**

- 1 = compressor
- 2 = cooling coil
- 3 = check/non-return valve
- 4 = receiver
- 5 = drying filters (2)
- 6 = activated charcoal filter
- 7 = particulate filter

Compressors shall only be operated with the appropriate oil as specified by the manufacturer as being suitable for the support of breathing quality air. Oil changes shall be at the interval periods as specified by the manufacturer or more frequently where arduous service of the equipment is undertaken. Generally oil shall be changed at periods not longer than six months or at intervals as recommended by the manufacturer of the equipment.

### **5.9** [Internal combustion engines](#)

Where internal combustion engines drive compressors, every care shall be taken to prevent the compressor from drawing in exhaust fumes from the engine, either by extending the exhaust of the engine or the inlet of the compressor or both. The compressor manufacturer should be consulted concerning the maximum length of and the minimum cross-sectional area of such extension to avoid reducing the efficiency of the compressor. In addition care must be exercised in the locating the compressor in the craft, reducing noise and also impact or injury with hot or moving parts. Allowing access to all hoses and fittings, especially the ability to blow down condensate drain cocks is essential in a timely manner for breathing quality of the air to be maintained.

### **5.10** [Avoidance of fumes](#)

Adequate precautions shall be taken to ensure that fume cannot ingress into any part of the compressor or breathing zone of personnel from any source. Specific attention to the change in weather conditions, wind direction, and ensuring that the engine exhaust of compressor, vessel or other source of fume never enters the compressor inlet is critical.

### **5.11** **Air receivers**

Air receivers and their fittings, attachments and valves shall be incorporated into the vessel or compressor system and shall comply with AS 1210.

### **5.12** **Non-return valves**

A non-return inlet valve shall be fitted between the compressor and the main receiver. The valve should, whenever possible, be fitted immediately adjacent to the receiver.

### **5.13** **Pressure relief valves**

A receiver shall be fitted with relief valves of large enough capacity to prevent the rated pressure of the receiver from being exceeded. The relief valve may be fitted at the lowest most extremity of the receiver in which case this aids with the removal of condensate drain from the vessel. In addition, compressors may also be fitted with 'off loading' mechanisms.

### **5.14** **Filters and dryers**

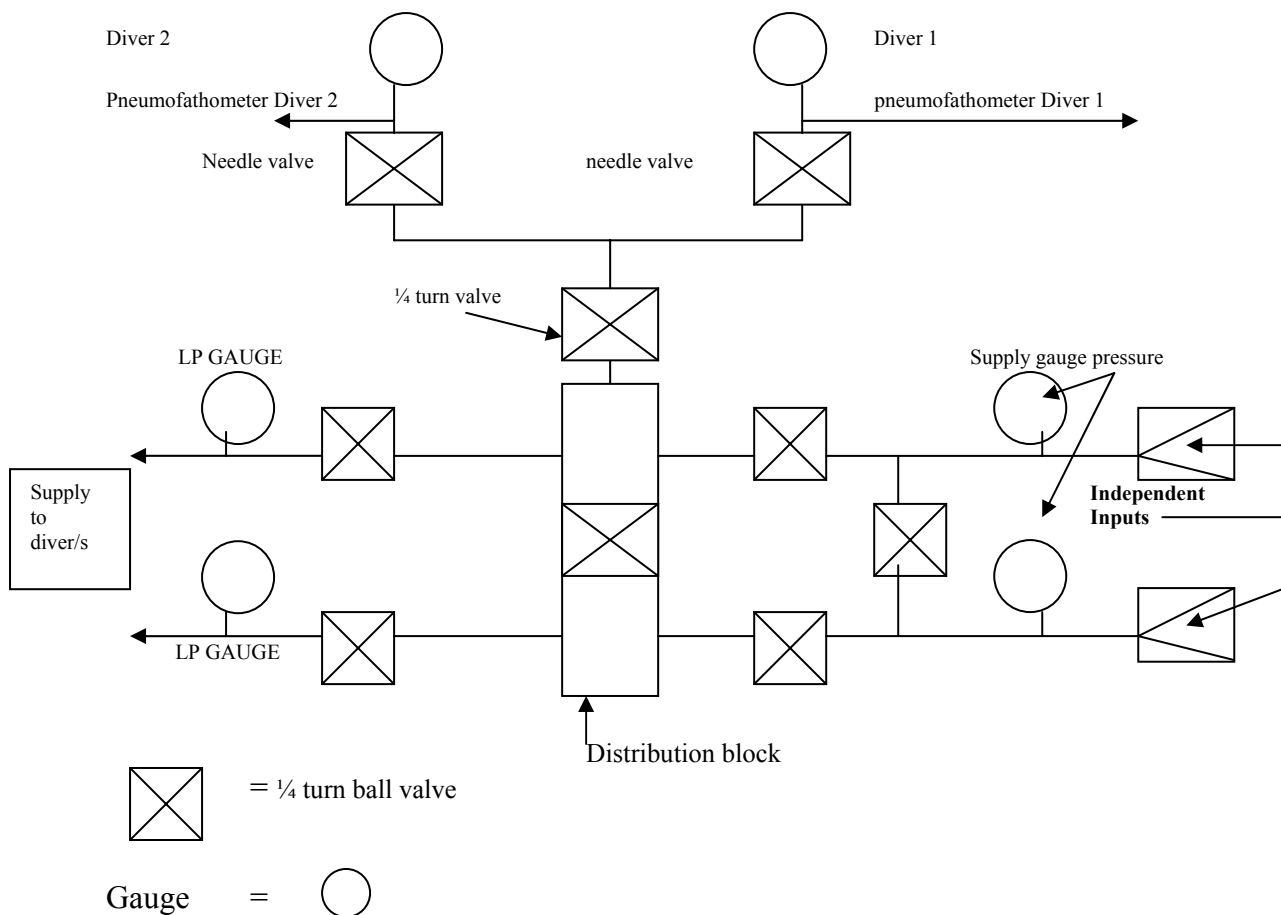
- a. Any air supply system shall provide adequate filtration to remove oil, water and poisonous or noxious fumes from the air to the levels as described in clause 3.33.
- b. Materials use for drying, filtration or odour absorption shall not introduce undesirable contaminants into the air supply.
- c. Drain cocks shall be provided to draw off any water and oil that may accumulate in the filters. The drain cocks shall be arranged so that they may be operated while the filter is in use.

## 5.15 Control system

- (a) The control system shall provide a suitable means for the control of air or gas from the primary and secondary air and divers air supply systems. The system shall include all appropriate check valves and non-return valves in a manner that they are easily observed.
- (b) Abalone diving is of a type that is conducted from small craft where size and weight is of prime concern. Larger commercial panels are not routinely used in this industry for these reasons, however the criteria for safely supplying air to the diver at all times does apply and remains paramount.

The key essential elements are:

**Table 5** – Typical diver control panel schematic



Single diver supply systems shall incorporate the same essential elements as above, including twin independent inputs, however only one output supply to one diver and one pneumo fathometer system or in place of the pneumo fathometer a separate system of depth measurement in accordance with clause 3.35 may be used.

**1.1.4** Standby diver shall be supplied from the panel above or may utilize any other system where applicable, provided such system is sufficient to enable the standby diver to adequately perform his or her task.

### 5.16 Supply lines

- (a) The supply lines between the compressor and the receivers shall be of either a permanent pipe, or high quality hose with external grade protection;
- (b) Air hose used for pneumatic tools shall not be used as a supply line;
- (c) Air and gas supply lines shall be located or guarded so that they are protected against mechanical damage, fatigue and vibration; and
- (d) All connections shall be secured in such a way to ensure both the internal kern of the hose and the external mantle are not damaged by the barb or hose clamp assembly. Worm drive hose clips shall not be used.
- (e) Supply lines shall be works tested.

### 5.17 Maintenance

- (a) Compressors and their power systems should at all times be strictly maintained and operated in accordance with the manufacturer's recommendations.
- (b) Manufacturer's recommendations for types of lubricating oils suitable for breathing air compressors for respiratory purposes shall be strictly adhered to.
- (c) Filter elements on the intake and delivery sides of the compressor should have their elements renewed as recommended by the manufacturer or more frequently where service intervals are high or contaminated gas is noted, notwithstanding filter elements are to be serviced at periods not exceeding 12 months.
- (d) Drain valves on compressor systems should be operated at momentary intervals, when the compressor is running, to prevent the accumulation of moisture. The frequency of opening is to reflect the minimum accumulation of oil or water as is reasonably possible.

### **5.18 Cylinder air or gas systems**

Where cylinders are used to supply gas to a diving system or diver/s by means of a bank of cylinders the following requirements apply:

- (a) Cylinders for compressed breathing gas shall comply with AS 2030.1 and relevant supplements;
- (b) The cylinder pressure shall be reduced by a suitable device capable of adjusting the diver's line pressure appropriately, ensuring adequate gas is supplied to the diver under all conditions of demand and depth;
- (c) The reducer may be of a type which is pre-set for the conditions which will be encountered by the diver;
- (d) Each bank of cylinders, or if used independently, shall be connected through the control system in such a manner that each can be isolated from the other while allowing the secondary bank to deliver gas to the diver; and
- (e) Adequately secured against movement or fall whilst in operation, transport or reasonable storage conditions.

## Section 6 – Boat operations

### **Boat operations**

Due to the inherent nature of boat operations, particular care of all aspects of operation, launching and recovery is to be exercised at all times.

#### **6.1 Launch and recovery**

In all cases where boats are to be launched and recovered, appropriate best practice shall be used. Compliance with the following is mandatory:

- (a) A lookout must be kept when reversing a boat and trailer;
- (b) No person is to place any part of their body between any fixed or moving components;
- (c) Lines are to be used to secure vessels, human muscle as the only force is not to be relied upon;
- (d) Winches are to be used where the amount of physical movement is equivalent to or greater than a lifting force of 15 kg and shall be subject to a risk assessment;
- (e) All craft are to be secured by approved rated shackles at all times the vessel is not being immediately launched or recovered; and
- (f) Due care for the public is to be exercised at all times.

#### **6.2 Hose/umbilical handling**

As the diver relies on the surface supply hose for the primary supply of breathing gas, care is to be exercised to ensure that the hose is not kinked, cut, snagged, chaffed or otherwise damaged in any way whilst diving operations are being conducted.

Furthermore, the deckhand/diver's attendant is to ensure that the diver at all times has sufficient hose to reduce fatigue, but not excessive as to retard the timeliness of passing or receiving signals from the diver to the surface and vice versa.

- (a) Extra care is to be taken to ensure that the propeller or propellers of the craft does not come into contact or the vicinity of the hose irrespective of vessel movement, wind, wave or current conditions; and
- (b) The hose shall be secured sufficiently aboard the vessel to ensure that excessive stress and strain cannot be applied to connections or fixtures of the diver's breathing system, compressor or cylinder bank as the case may be.

#### **6.3 Diver recovery**

- (a) A suitable system shall be employed to enable the crew to adequately recover the unconscious body of a diver aboard the vessel unaided by any outside person or equipment;
- (b) Such system may incorporate a winch, gantry, net or rope system and shall be adequate for the job with the usual crew operating the vessel;
- (c) At least annually, or more frequently where crews are changed, a training drill ensuring proper recovery of a diver is practiced; and
- (d) All recovery equipment shall be maintained onboard vessels at all times the vessel is conducting commercial abalone fishing operations.

#### **6.4 Emergency procedures/provisions**

As abalone diving is conducted in waters where, in some cases, radio and mobile telephone communications is unreliable, crews of craft are to ensure that they are aware of zones and areas which enable proper and reliable radio communications to be established and maintained.

- a) Each vessel shall have procedures, known to all crew, which enable locations to be known and adopted which ensure adequate communications to be made and maintained;
- b) When an emergency situation occurs it is dependant on the crew as to the appropriate procedures or locations to be sought to render the most timely and appropriate first aid or support;
- c) Other vessels or craft in the vicinity should also be included in the possible options for assistance under these circumstances but never be relied upon as an always-available resource; and
- d) Diving shall not take place where communications, either directly or indirectly to shore cannot be maintained.

## Section 7 - Accident reporting

### **7.1 Accident and incident reporting**

In all cases in which a diver or crewmember has been involved in an incident or accident, dangerous occurrence or received a serious or fatal injury whilst engaged in or as a result of a diving operation, the supervisor shall prepare a report of the circumstances in which the diver or crew member sustained the injury or death. In all cases, action shall be immediately taken to ensure the Regulatory Authority is notified as soon as practicable after the occurrence of the incident.

Attention is drawn to the requirements of the Occupational Health & Safety (Incident Notification) Regulations 1977.

### **7.2 Composition of the report**

The report shall contain the following:

- (a) A summary of aspects of the accident, dangerous occurrence or incident, specifying-
  - a. The name of the diver or crewmember;
  - b. The date, location and time of the incident;
  - c. Details of the diving experience of the diver;
  - d. The cause of the incident;
  - e. The supervisor's recommendations to prevent a recurrence; and
  - f. The nature of the injury (if any) sustained by the diver or crewmember.
- (b) Full narrative statement from all persons (including the supervisor and if practicable, the diver and diver's attendant) who were engaged in the relevant diving operation and who can detail any relevant information pertinent to the occurrence.
- (c) Such medical reports, in relation to the diver or person involved, as are available, being reports compiled both before and after the occurrence of the incident;
- (d) Where applicable the full details of the type of diving apparatus used by the diver, in particular noting the condition of such equipment immediately after the incident, in the appropriate case –
  - a. Whether cylinder valves were opened or closed, and to what extent;
  - b. Remaining pressures in the cylinder/s;
  - c. The position of the emergency supply valve; and
  - d. The oxygen concentration of the gas mixture, together with an analysis of the air or mixture for compliance with clauses 3.33 and 3.34 as applicable.

### **7.3 Disposition of equipment**

- a) In any case in which component malfunction was likely or suspected to have been a likely cause of a reportable serious incident, then this equipment shall be immediately sealed and conveyed to an appropriate laboratory for testing and report.
- b) In any case where a fatality has occurred, all equipment shall be left in the condition it was at the time of the accident until it has been investigated by the relevant authorities.
- c) Notwithstanding the above, the supply of gas of the equipment shall be noted and isolated to retain the remaining gas.
  - 1) During such isolation the number of turns, any undue force or other actions, required to isolate the air supply shall be noted and recorded in writing.
- d) The supervisor shall forward one copy of the report to the local regional office of Worksafe.

## Appendix

### **A Medical Standards for Workers in Underwater Breathing Operations**

Refer to AS 2299 for details

### **B Decompression Tables for Diving (Sample)**

Refer to AS 2299 for details

### **C Treatment for Decompression sickness**

Refer to AS 2299 for details

### **D Minimum Qualification for Divers**

The degree of competence, which the diver shall have attained to be considered a 'qualified' person, is largely dependent upon the type of equipment or diving apparatus being employed. Clearly a diver being employed in a situation, which uses SSUBA, would need to be competent to use SCUBA with a minimum of at least 40 days experience as an abalone diver and has reached the skill levels as required to enable the diver to safely and competently complete the tasks as required.

The abalone industry is one, which has over time not relied on qualifications as a pre-requisite but rather competency. Therefore, as the industry moves forwards, it is recognised that there needs to be a system where existing competencies are acknowledged by this standard. The abalone industry acknowledges that an abalone diver who has recorded a verifiable proof of experience of having completed 40-days diving as a commercial abalone diver has reached the required skill qualifications and competency standards to fulfil the requirements of this standard.

It is recommended therefore that all future divers wishing to enter into the Victorian Abalone Industry after the date of adoption of this document who have not completed 40-days of competency or other experience in the abalone industry will be required to complete an approved course of instruction as per **“Appendix h”**.

The administration of the system would then be undertaken by an approved and appointed reference group formulated with internal and external membership of competent persons to be established from within the Abalone Industry with appropriate external guidance where and if required.

**E Diver's Logbook (Sample only)**

Refer to "G" below for example

**F Lifeline and hand signals (Sample only)**

	<i>Tender to Diver</i>	<i>Diver to Tender</i>
1 pull	Are you all right?	I am all right
2 pulls	Go down!	Give me slack!
3 pulls	Stand-by to come up!	Take in my slack!
4 pulls	Come up!	Haul me up!

### Line pull signals - Sample

From tender to diver

1 Pull	"Are you all right?"
When diver is descending, one pull means "stop"	
2 Pulls	"Going down"
During ascent, 2 pulls mean "you have come up too far, go down until we stop you"	
3 Pulls	"Stand by to come up"
4 Pulls	"Come up"
2-1 Pulls	"I understand," or "Answer the telephone"
3-2 Pulls	"Ventilate"
4-3 Pulls	"Circulate"

### **From diver to tender**

1 Pull	"I am all right"
When descending, one pull means 'stop' or "I am on the bottom"	
2 Pulls	"Lower" or "Give me slack"
3 Pulls	"Take up my slack"
4 Pulls	"Haul me up"
2-1 Pulls	"I understand" or "Answer the telephone"
3-2 Pulls	"More air"
4-3 Pulls	"Less air"

### **Special signals from the diver**

1-2-3 Pulls	"Send me a square mark"
5 Pulls	"Send me a line"
2-1-2 Pulls	"Send me a slate"

### **Searching signals - Without circling line**

7 Pulls	"Go on (or off) searching signals"
1 Pull	"Stop and search where you are"
2 Pulls	"Move directly away from the tender if given slack, move toward the tender if strain is taken on the life line"
3 Pulls	"Go to your right"
4 Pulls	"Go to your left"

### **Searching signals - With circling line**

7 Pulls	Same
1 Pull	Same
2 Pulls	"Move away from the weight"
3 Pulls	"Face the weight and go right"
4 Pulls	"Face the weight and go left"

### **EMERGENCY**

### **SIGNALS FROM THE DIVER**

2-2-2 Pulls	"I am fouled and need the assistance of another diver"
3-3-3 Pulls	"I am fouled but can clear myself"
4-4-4 Pulls	"Haul me up immediately"

ALL EMERGENCY SIGNALS WILL BE ANSWERED AS GIVEN EXCEPT FOR  
4-4-4

## SAMPLE UNDERWATER COMMUNICATION SIGNALS



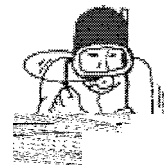
Me, or watch me



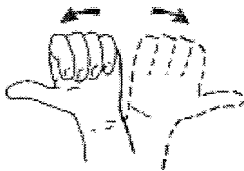
Come here



Go that way



I am cold



Which direction?



Yes



No



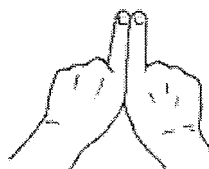
Take it, easy, slow down



Ears not clearing



Hold hands



Get with your buddy



Look



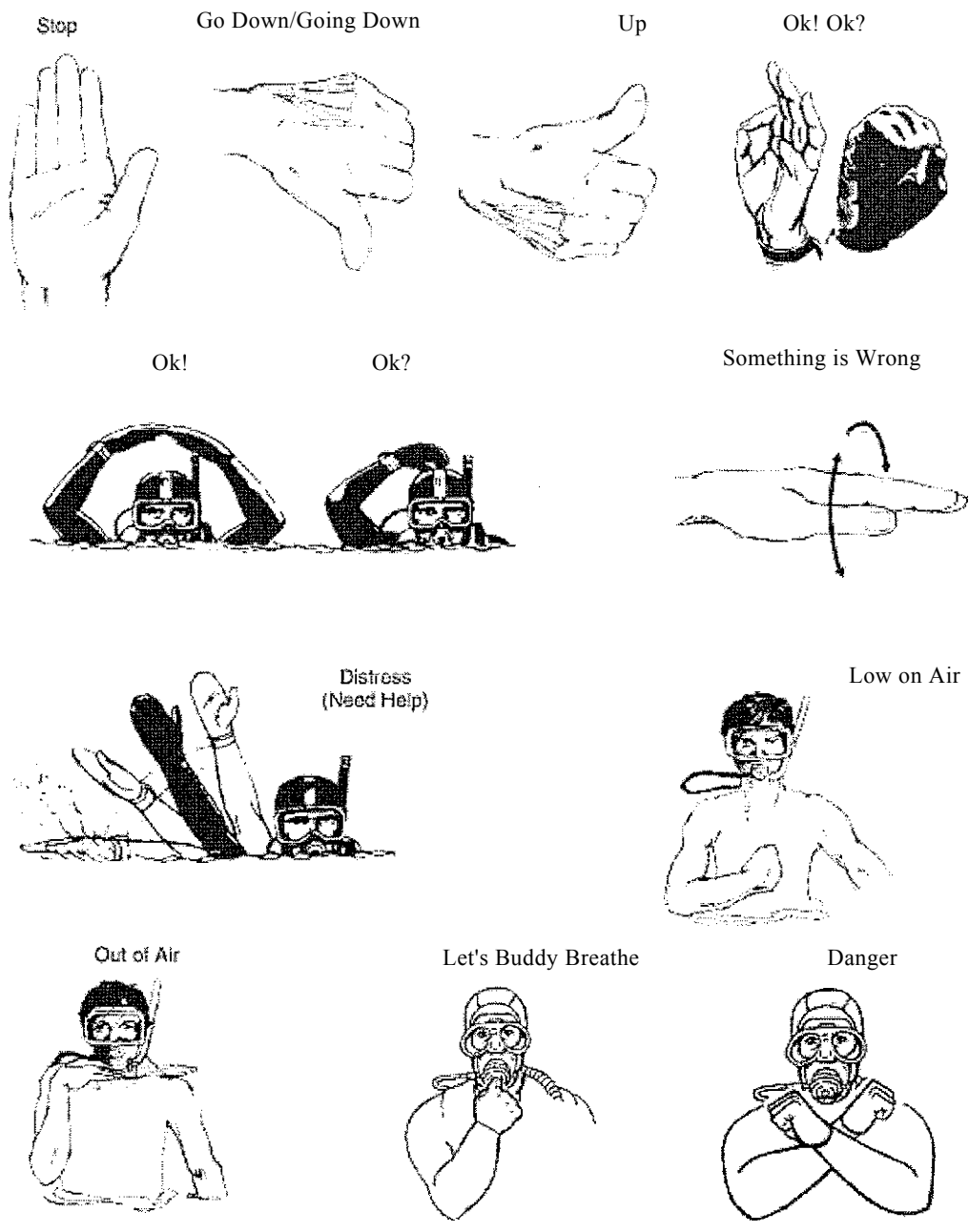
You lead, I'll follow



What time? What depth?



I don't understand



The above diagrams courteously provided by VADA<sup>4</sup>

<sup>4</sup> VADA – Victorian Abalone Divers Association

## G Abalone Docket Sample

Serial Number 9999999

ACCESS Licence Number A 0000

ABALONE DOCKET ( \_\_\_\_\_ Zone)

**PART – A RESOURCE MANAGEMENT** – To be completed by an abalone Fishery Access Licence Holder or any person authorised to act under that licence.  
LML Report Number/s \_\_\_\_\_

Reef Industry	No of Bins per Reef Industry	Estimated Diving Time Per reef Industry		Actual weight of abalone in kilograms per reef Industry		Total weight of all abalone
		Hours	Minutes	Species other than greenlip	Greenlip	

**PART – B QUOTA MANAGEMENT** – To be completed by an abalone Fishery Access Licence Holder or any person authorised to act under that licence.  
Nominated Diver’s Name \_\_\_\_\_ Nominated Divers Personal File Number \_\_\_\_\_

Time of Landing \_\_\_\_\_ (24 Hours) Date of Landing \_\_\_\_\_ Boat Registration \_\_\_\_\_

Place of landing \_\_\_\_\_ Full name of Deckhands/s \_\_\_\_\_

Number of bins or bags of abalone landed \_\_\_\_\_ Figures \_\_\_\_\_ words

Total Tare weight (in kilograms) of bins or bags (Including bin lids & inserts)  
\_\_\_\_\_ Figures \_\_\_\_\_ words

Serial numbers of bin tags affixed to bins or bags of abalone landed \_\_\_\_\_

Full name of person or carrier transporting abalone \_\_\_\_\_

Abalone is to be delivered to \_\_\_\_\_

Full name of licenced fish receiver (abalone) to whom abalone is being delivered  
Time of weighing \_\_\_\_\_ (24 Hours) Total net weight of unshucked abalone (in kilograms) \_\_\_\_\_ figures  
\_\_\_\_\_ words

Notification service details: Confirmation number \_\_\_\_\_

I certify that the information provided in parts A & B of this docket is true and correct in every detail

Signed \_\_\_\_\_ Dated \_\_\_\_\_

**PART C** – To be completed by licenced fish receiver (abalone)

Notification service details: Confirmation number \_\_\_\_\_

Abalone first received by \_\_\_\_\_ Trader number \_\_\_\_\_

At \_\_\_\_\_ Time of receipt \_\_\_\_\_ (24 Hours) Date of receipt \_\_\_\_\_

To be completed if abalone not received at licenced premises

Total net weight of unshucked abalone (in kilograms)

\_\_\_\_\_ Figures \_\_\_\_\_ Words

I certify that the information provided in PART C of this docket is true and correct in every detail.

Signed \_\_\_\_\_ (Print full name) \_\_\_\_\_ Dated \_\_\_\_\_

Inspection Details: Licence number of entity inspected \_\_\_\_\_ date of inspection \_\_\_\_\_

Name of authorised officer \_\_\_\_\_ signature \_\_\_\_\_

**Further details for diving log**

Diver's name \_\_\_\_\_ - Name of boat \_\_\_\_\_  
If different from the nominated diver

Supervisor's name \_\_\_\_\_ - Boat Reg No \_\_\_\_\_

Deckhand/attendant's name \_\_\_\_\_ -

Maximum depth reached \_\_\_\_\_ metres

Geographic Location \_\_\_\_\_

Bottom time \_\_\_\_\_ Mins (May be cumulative when diving shallower than 10 metres,

Equipment used

Compressor SSUBA                      Type of regulator or helmet used \_\_\_\_\_

Cylinders SSUBA                      If using a computer list brand/name \_\_\_\_\_

Gas used \_\_\_\_\_                      Tables used \_\_\_\_\_

Remarks – (indicate any unusual aspects of the dive, equipment malfunction etc)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Cumulative hours \_\_\_\_\_ Signed by diver \_\_\_\_\_

Signed by supervisor \_\_\_\_\_ date \_\_\_\_\_



## H                      **Training Standards**

These draft-training standards form a basis for abalone diver training under the direction of the Abalone Industry © 2004 OH&S Solutions.

<b><i>Detail</i></b>	<b><i>Date Completed</i></b>	<b><i>Signed Student</i></b>	<b><i>Signed Instructor</i></b>	<b><i>Signed Director</i></b>
2.1.1 Relationship between pressure and volume (Boyle's Law) Calculate the volume changes with changing depths.				
2.1.2 Relationship between pressure and temperature (Charles' Law). Calculate the pressure changes with changes in temperature				
2.1.3 Partial pressure of gases (Dalton's Law). Calculate the partial pressure of gases at different depths.				
2.1.4 Solubility of gases in solution (Henry's Law) Explain the solubility effect of gases in liquids and the need for decompression.				
2.1.5 Buoyancy (Archimedes' Principle) Calculate the buoyancy of various objects at different Depths.				
2.2.1 Dive safely and competently using self-contained diving equipment in sheltered and open water in varying bottom conditions and water visibility. This skill is to demonstrate successful bail out techniques from surface supply.				

<i>Detail</i>	<i>Date Completed</i>	<i>Signed Student</i>	<i>Signed Instructor</i>	<i>Signed Director</i>
2.2.2 Dive safely and competently to a depth of 20-m using self-contained diving equipment to the reserve limit of the breathing set.				
2.2.3 Dive safely and competently to a depth of 20-m using two types of surface supplied diving equipment one of which must be with standard dress (rigid helmet with free-flow primary or tuneable demand air supply).				
2.2.4 Carry out emergency drills applicable to self-contained and surface supplied diving equipment.				
2.2.5 Dress and undress divers using self-contained and surface supplied diving equipment.				
2.2.6 Perform user maintenance of self-contained and surface supplied diving equipment and prepare equipment for use.				
2.2.7 Perform repairs and test to diving suits and ancillary equipment.				
2.3.1 Outline the pattern of tidal movements and how to determine the depth of water and tidal direction in a given place at a given time.				
2.3.2 Recognise the standard symbols used on charts and how distance, position and direction are determined.				
2.3.3 Outline the principles of handling a small craft in harbour and at sea in varying water conditions.				
2.3.4 State the essential safety equipment to be carried in a small craft and its use.				
2.3.5 Handle an Abalone craft under supervision.				

<i>Detail</i>	<i>Date Completed</i>	<i>Signed Student</i>	<i>Signed Instructor</i>	<i>Signed Director</i>
2.4.1 Recognise, identify, interpret and correctly respond to hand and rope signals from diver to surface, surface to diver, and diver to diver.				
2.4.2 Outline the basic principles of underwater communication and diver intercom systems.				
2.4.3 Use underwater communication and diver intercom systems for communication from diver to surface, surface to diver.				
2.4.4 Carry out user maintenance of underwater communication and diver intercom systems.				
2.5.1 Outline current underwater search methods and locate an object using two of them.				
2.5.2 Produce a report based on an underwater/survey of an underwater structure or feature.	Omitted			
2.5.3 Outline the basic principles of various underwater inspection and measurement techniques including video inspection.	Omitted			
2.5.4 Outline the basic principles of non-destructive testing.	Omitted			
2.5.5 Handle safely and efficiently cordage, wire, ropes, blocks, and tackle, chain hoists, associated winches, tirlors and working stages on the surface and underwater.	Omitted			
2.5.6 Complete underwater tasks safely and efficiently using a range of hand tools, eg. wrenches, hammers, chisels, and hacksaws.	Omitted			
2.5.7 Outline the methods of operation, hazards and safety requirements of compressed air and hydraulically operated tools.	Omitted			
2.5.8 Complete underwater tasks safely and efficiently using various lift bags.				

<i>Detail</i>	<i>Date Completed</i>	<i>Signed Student</i>	<i>Signed Instructor</i>	<i>Signed Director</i>
2.5.9 Perform user maintenance of compressed air and hydraulic tools.	Omitted			
2.5.10 Outline the principles, methods of operation and safety requirements of high pressure and low-pressure lifting bags.				
2.5.11 Use of low pressure or high-pressure inflation systems & lifting bags safely and efficiently.				
2.5.12 Carry out user maintenance of water jetting equipment, airlifts and lifting bags.	Omitted			
2.5.13 Outline the principles, method of operation, safety requirements and uses of thermal arc cutting equipment.	Omitted			
2.5.14 Outline the principles, method of operation and safety precautions to be taken when using oxy-arc cutting equipment.	Omitted			
2.5.15 Use oxy-arc cutting equipment safely and efficiently to cut "I" beam, pipe and flat steel plate up to 25 mm in thickness.	Omitted			
2.5.16 Perform user maintenance of oxy-arc cutting equipment.	Omitted			
2.5.17 Outline the principles, method of operation and safety precautions to be taken when using current methods of underwater electric arc welding.	Omitted			
2.5.18 Outline the types of explosives currently available for underwater use, their common usage and relevant Statutory Regulations.	Omitted			
2.5.19 Outline the use of explosives and the setting of firing circuits and their initiation using electrical and non-electrical methods and handle equipment under classroom conditions.	Omitted			

<i>Detail</i>	<i>Date Completed</i>	<i>Signed Student</i>	<i>Signed Instructor</i>	<i>Signed Director</i>
2.5.20 Outline the elementary principles of construction methods and practices associated with underwater structures and interpret relevant/simple-engineering drawings.	Omitted			
2.6.1 Outline the hazards to divers of water flow around or through underwater structures (including gates, pipelines, culverts, sewers and intakes) and explain the safety precautions to be taken.	Omitted			
2.6.2 Outline the hazards to divers from explosives, electrical apparatus and marine animals.	Modified to omit explosives and electrical apparatus.			
2.7.1 Outline the principles, method of operation and health and safety requirements of high pressure and low-pressure air compressors.				
2.7.2 Operate safely and efficiently and carry out user maintenance of high pressure and low-pressure air compressors.				
2.7.3 Transfer gases into and out of high pressure air banks safely and efficiently.				
2.7.4 Operate and carry out user maintenance of associated air filtration equipment.				
2.8.1 Interpret and apply standard air decompression tables.				
2.8.2 Outline procedures for surface decompression.				
2.8.3 Outline the principles of compression chamber operation and the use of air and oxygen therapeutic tables.				
2.9.1 Outline the respiratory, circulatory, basic skeletal and nervous systems of the body.				
2.9.2 Outline the basic need for and problems associate with maintaining the normal body temperature of the diver.				

<i>Detail</i>	<i>Date Completed</i>	<i>Signed Student</i>	<i>Signed Instructor</i>	<i>Signed Director</i>
2.9.3 Describe the changes and systems caused by breathing too high or too low a concentration of oxygen or too high a concentration of nitrogen.				
2.9.4 Apply first aid treatment in typical diving emergencies.				
2.9.5 Apply first aid treatment to minor injuries.				
2.9.6 Apply first aid treatment to an unconscious person.				
2.9.7 Describe the symptoms and treatment for injuries/illness caused by contact with dangerous marine animals.				
2.10.1 Outline the relevant statutory provisions and the provisions of AS 2299 and other relevant codes – Abalone Industry Standard & others (eg. AS 2030).				
2.11.1 All completed assignments are appended here after review by the student and being signed as being understood and reviewed.				
2.11.2 All candidates shall read and review all examination answer sheets after sheets have been marked. Students will then be asked to sign that they have reviewed their answer sheets and understand the correct answers to the questions thereon				
2.11.3 Outline the compliance requirements of the Fisheries Act, Licence provision requirements and zone boundaries				
2.11.4 Identify species, size limitations, breeding characteristics, topography and collection methods for fish.				
2.11.5 Demonstrate methods to ensure increases of productivity in catch management, safety, dive planning and environmental resource management.				

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By Frank Zeigler – OH&S Solutions

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This document comprises 51 pages and should be read in conjunction with AS 2299 as reference for some of the appendix standards and referenced documents.

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E&OE