

Australian/New Zealand Standard™

Occupational diving operations

Part 2: Scientific diving



Standards Australia



AS/NZS 2299.2:2002

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Australian Industry Group
Australian Marine Sciences Association
Australian Medical Association
Australian Seafood Industry Council
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Australian/New Zealand Standard™

Occupational diving operations

Part 2: Scientific diving

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee SF-017, Occupational Diving.

This Standard is Part of a series of Standards for the conduct of occupational diving operations. Diving operations which fall into the scope of this sector-specific Standard may be conducted using either this Standard or AS/NZS 2299.1, *Occupational diving operations Part 1: Standard operational practice*.

This Standard is based on a draft prepared by the Australian Marine Sciences Association. An earlier version of the draft was released for comment by Standards Australia Committee MS-053, Scientific Diving, in 1991.

The provision of guidance on delay times between diving and altitude exposure was considered at length during preparation of this Standard. Internationally, there are many different recommendations regarding appropriate limits for altitude exposure following diving and extensive public comment was received which made it clear that previous delay to altitude exposure tables have been interpreted as rules which were excessively restrictive for certain situations. Local and international diving medicine experts were consulted and the Committee agreed to encourage diving operators to obtain specialist advice to assist in working out delay protocols to suit their particular situation prior to the diving operation's commencement. It was also agreed to continue to include one set of guidelines that may be used when an individualized protocol had not been arranged but these guidelines have been moved to an informative appendix to reinforce their status as one consensus recommendation only, rather than the definitive publication on this subject. The values in the guidelines provided in this Standard are generally consistent with other published guidelines. The importance of normal health before travel to altitude has been emphasized in view of the frequency with which altitude associated decompression illness seems to be preceded by at least some pre-travel warning symptoms.

The Committee also sought local and overseas expert opinion concerning on-site compression chamber availability requirements. Public comment requested that the Committee consider the difficulty in applying the risk-based table in the Draft for Comment, which was a minor update of that published in the 1999 edition of AS/NZS 2299.1. Particular difficulties were raised with applying this table to repetitive dives and there were requests for the use of the no-decompression limits in the Canadian Defence and Civil Institute of Environmental Medicine (DCIEM) decompression tables as a versatile, consistent and readily implementable alternative means of determining compression chamber needs. The risk-based table was originally introduced to make requirements for compression chamber support more evidence based. The Committee acknowledged that whilst the previous table was based upon decompression illness risk equivalence, the decompression illness (DCI) risk levels chosen to require chamber availability and the travel times selected were derived from expert opinion rather than hard data. Further, while the data set used as the original table's source is the largest, most analysed set available, the dives that provided the data may not necessarily reflect the types of dives conducted during onshore commercial diving and scientific diving, where multi-level dive profiles are often used. The Committee, therefore, agreed to the request to use DCIEM table limits, which were noted to have received extensive field usage in a range of types of diving.

While investigations indicated DCIEM tables could be used for some dive depths, DCIEM suggested to the Committee that more conservative limits should be set for dive depths up to 12 m. The resultant process published in this Standard for determining the level of compression chamber support required for a diving operation is considered suitable for application to the types of diving covered by both this Standard and by AS/NZS 2299.1.

is intended to revise the corresponding compression chamber availability requirements in AS/NZS 2299.1:1999 in a similar manner. It should be noted that reliance solely upon dive depth and time for determining compression chamber needs was not supported. Requirements for on-site chamber support of dives involving certain types of work or factors that significantly increased risk of arterial gas embolism or high gas load/rapid progression decompression illness have been included.

Also in early deliberations, the Committee planned to use the competencies for scientific divers set out in Appendix A of this Standard as new text for some Parts of the AS 2815 series on training and certification of occupational divers when it was revised. However, it became apparent that the alignment of competencies and training course contents for the scientific sector of the diving industry and for those who used the AS 2815 series was not achievable in the short term. Regulatory interests registered particular concern over the limited range of training exercises required prior to qualification as a scientific diver. The Australian Diver Accreditation Scheme and The National Association of Occupational Diver Training Establishments (Australia) considered the training was reduced too much from that in the AS 2815 series and a mechanism for quality assurance of certification providers should be included. The Committee intends to continue working towards a time when competency and training details align with new qualifications in a revised AS 2815 series that provides competencies for each form of occupational diving.

The illustrations for the hand signals shown in Appendix C are reproduced with the permission of PADI Asia Pacific Pty Ltd.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

CONTENTS

Page

SECTION 1 SCOPE AND GENERAL

1.1	SCOPE.....	6
1.2	OBJECTIVE	6
1.3	APPLICATION	6
1.4	REFERENCED DOCUMENTS.....	7
1.5	DEFINITIONS.....	8
1.6	RELATIONSHIP WITH LEGISLATION	11

SECTION 2 PERSONNEL FOR DIVING OPERATIONS

2.1	EMPLOYER.....	12
2.2	DIVING OFFICER.....	12
2.3	DIVE COORDINATOR	12
2.4	DIVE LEADER	13
2.5	DIVER.....	13
2.6	DIVER'S ATTENDANT	14
2.7	STANDBY DIVER.....	14
2.8	SUPERVISION OF HEALTH	15
2.9	FIRST AID FOR DIVING TEAMS.....	15
2.10	RECORDS.....	16

SECTION 3 ORGANIZATION AND PLANNING

3.1	GENERAL.....	18
3.2	DIVE SITE REGISTRATION AND RISK ASSESSMENT	18
3.3	DIVE PROPOSAL.....	18
3.4	ON SITE PRE-DIVE PLAN AND RISK ASSESSMENT	19
3.5	SELECTION OF BREATHING APPARATUS.....	19
3.6	SURFACE CONDITIONS.....	20
3.7	IN-WATER CONDITIONS	20
3.8	DEPTHS	20
3.9	WATER TEMPERATURES.....	20
3.10	HAZARDOUS CONDITIONS	20
3.11	DIVING AT NIGHT.....	21
3.12	COMMUNICATIONS.....	21
3.13	FIRST AID, MEDICAL AND EMERGENCY SERVICES.....	21
3.14	DECOMPRESSION DIVING.....	22
3.15	COMPRESSION CHAMBER SUPPORT OF DIVING.....	23
3.16	DIVING BEFORE OR AFTER TRAVEL	25

SECTION 4 DIVING EQUIPMENT

4.1	BREATHING APPARATUS.....	26
4.2	BREATHING GAS SUPPLIES	29
4.3	PRESSURE GAUGES.....	29
4.4	EMERGENCY GAS SUPPLIES	30
4.5	GAS SUPPLY SAFETY WARNING SYSTEM.....	30
4.6	AIR COMPRESSOR SYSTEMS	31
4.7	SSBA BREATHING GAS SUPPLIES AND CONTROL SYSTEMS	33
4.8	PNEUMATIC TOOLS.....	35
4.9	LIFELINE.....	35
4.10	DIVING SUIT	36

	<i>Page</i>
4.11 WEIGHTS	36
4.12 DIVER'S KNIFE	36
4.13 SURFACE SIGNALLING DEVICE.....	36
 SECTION 5 PROCEDURES FOR SCUBA DIVING	
5.1 GENERAL.....	37
5.2 PERSONNEL REQUIRED.....	37
5.3 DIVING EQUIPMENT AND BREATHING GAS SUPPLIES.....	39
5.4 LOW VISIBILITY	40
5.5 BOATS—EQUIPMENT AND OPERATION.....	40
5.6 DIVING FROM SHORE	40
5.7 TERMINATION OF DIVE.....	40
 SECTION 6 PROCEDURES FOR SSBA DIVING OPERATIONS	
6.1 GENERAL.....	42
6.2 PERSONNEL REQUIRED.....	42
6.3 LIFELINE.....	43
6.4 DIVING EQUIPMENT AND BREATHING GAS SUPPLIES.....	43
 SECTION 7 DIVING ACCIDENTS	
7.1 ACCIDENT REPORT	45
7.2 INVESTIGATION OF ACCIDENTS AND INCIDENTS	45
 SECTION 8 RECIPROCITY	
8.1 INTENT.....	46
8.2 CERTIFICATION	46
 APPENDICES	
A MINIMUM COMPETENCIES, TRAINING AND CERTIFICATION FOR SCIENTIFIC DIVERS	47
B DIVING OPERATIONS MANUAL	60
C HAND SIGNALS	64
D LIFELINE SIGNALS	66
E EXAMPLE OF DIVER'S LOGBOOK	67
F EXAMPLE OF EMPLOYER'S RECORD SHEET	68
G HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL	70
H GUIDELINES REGARDING EXPOSURE TO ALTITUDE FOLLOWING DIVING	73

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Australian/New Zealand Standard
Occupational diving operations**Part 2: Scientific diving**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for occupational underwater diving operations performed at a place of work for the purpose of professional scientific research, natural resource management or scientific research as an educational activity. This Standard applies to diving in water to depths not exceeding 39 m in the case of no-decompression diving and 30 m otherwise, where breathing gas is supplied through either self-contained underwater breathing apparatus (SCUBA) or surface-supplied breathing apparatus (SSBA).

NOTE: Without limiting the scope of this Standard, there may be diving tasks or situations which require a scientific diver to operate under other diving standards.

This Standard includes requirements and recommendations for personnel, procedures and the equipment and breathing medium supply utilized, together with appendices containing the following:

- (a) Personal records of divers.
- (b) Examples of employer's records of dives.
- (c) Contents of a diving operations manual.
- (d) Hand signals.
- (e) Lifeline signals.
- (f) Qualification levels for scientific divers.

1.2 OBJECTIVE

The objective of this Standard is to provide the scientific diving industry with a set of minimum requirements to provide uniformity of practice in relation to the health and safety of those people engaged in occupational underwater operations for the purpose of scientific diving.

1.3 APPLICATION

This Standard applies to persons directly involved in scientific diving operations, organizations employing those persons and industries supplying equipment for use in connection with scientific diving operations. This Standard has been developed for diving activities using air or oxygen-nitrogen mixtures where the oxygen concentration is in the range of 20% to 22%. Although this Standard may be used for guidance for diving activities using oxygen-nitrogen mixtures with higher or lower concentrations, additional training and procedures will be necessary. Similarly, this Standard may be used for guidance for diving activities in liquids other than water and for breathing apparatus such as rebreather units with the appropriate additional training and procedures.

This Standard does not apply to—

- (a) recreational diving;
- (b) diving by undergraduate students in tertiary courses;
- (c) diving beyond 39 m depth; and
- (d) diving covered by other Standards in the AS/NZS 2299 series.

NOTES:

- 1 For the types of diving in Items (a), (b) and (c) above, the relevant regulatory authority should be consulted.
- 2 Specialized gas mixing, filling, analysis and diving procedures are necessary for safe diving using breathing gases other than air. In particular, special equipment selection and cleaning procedures are needed for diving using oxygen enriched gas mixtures. These additional procedures for using breathing gases other than air should be included in the diving operations manual.

1.4 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- | | |
|--------|--|
| 1210 | Pressure vessels |
| 1885 | Measurement of occupational health and safety performance |
| 1885.1 | Part 1: Describing and reporting occupational injuries and disease (known as the National Standard for workplace injury and disease recording) |
| 2030 | The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases |
| 2030.1 | Part 1: Cylinders for compressed gases other than acetylene |
| 2815 | Training and certification of occupational divers |
| 2815.1 | Part 1: SCUBA diving to 30 m |
| 2815.2 | Part 2: Air diving to 30 m |
| 2815.3 | Part 3: Air diving to 50 m |
| 2815.4 | Part 4: Bell diving |
| 3848 | Filling of portable gas cylinders |
| 3848.2 | Part 2: Filling of portable cylinders for self-contained underwater breathing apparatus (SCUBA) and non-underwater self-contained breathing apparatus (SCBA)—Safe procedures |
| 4484 | Industrial, medical and refrigerant compressed gas cylinder identification |

AS/NZS

- | | |
|--------|--|
| 1337 | Eye protectors for industrial applications |
| 2299 | Occupational diving operations |
| 2299.1 | Part 1: Standard operational practice |

ISO

- | | |
|------|------------------------------------|
| 2230 | Vulcanized rubber—Guide to storage |
|------|------------------------------------|

Commonwealth of Australia

National Measurement Act 1960

International Maritime Organization

International Regulations for Preventing Collisions at Sea (1972)

National Occupational Health and Safety Commission

NOHSC

1010 National standard for plant

New Zealand Government

Health and Safety in Employment Regulations 1995

UNESCO

UNESCO Technical Papers in Marine Science 53, Code of Practice for Scientific Diving (1990).
Eds. N.C. Flemming and M.D. Max

1.5 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.5.1 Belt block

A redundant breathing gas supply system that has its controls positioned at the front of the diver's body on a belt.

1.5.2 Bottom time (BT)

The total elapsed time from when a diver leaves the surface to the time (next whole minute) at which the final ascent to the surface is commenced, measured in minutes.

1.5.3 Breathing hoses

Hoses attached to a regulator that are designed to—

- (a) supply breathing gas to the diver;
- (b) carry away expired breathing gas; and
- (c) operate at near ambient pressure.

1.5.4 Buddy diver

A member of a group of two or three divers.

1.5.5 Competent person

A person who has acquired, through training, qualifications or experience (or a combination of these), the knowledge and skills enabling that person to safely perform a specified task.

1.5.6 Compression (recompression) chamber

A pressure vessel at the surface designed and equipped for human occupancy which enables persons to be subjected to increased pressure for therapeutic, decompression or training purposes.

1.5.7 Decompression illness

A generic term for acute illness resulting when pathological consequences arise from decompression. This term covers the condition known as 'decompression sickness' (also known as 'bends') and arterial gas embolism, but does not include barotrauma of ascent.

1.5.8 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 in terms of maximum depth (MSW) and bottom time (minutes).

1.5.9 Decompression stop

The specified 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 safe ascent to the next decompression stop or the surface.

1.5.10 Dive coordinating position

A single, designated location on the surface, adjacent to where a diver enters the water, from which the diver's safety is monitored.

1.5.11 Dive coordinator

A person who supervises and coordinates any dive and is responsible for dive team safety.

1.5.12 Dive leader

A person in charge of a specific part of a diving operation.

1.5.13 Diver

A person who performs diving work underwater and who, for the purposes of this Standard, is trained and experienced in accordance with one of the categories described in Appendix A.

1.5.14 Diving officer

A person who has been nominated in writing by the employer and is ultimately responsible for all diving activities.

1.5.15 Diving program

One or more dives that are related by purpose, place or time to form a series.

1.5.16 Diving team

Divers and support personnel operating together.

1.5.17 Diving work

Work in which diving is conducted using underwater breathing apparatus, including work by the dive team in direct support of the diver.

1.5.18 Effective bottom time (EBT)

For a diver carrying out repetitive diving, the bottom time calculated after taking into consideration the residual nitrogen from previous dives.

1.5.19 Effective depth

For a dive at altitude, the depth of an equivalent dive at sea level.

1.5.20 Exceptional exposure dive

A dive where the maximum recommended dive time for a particular depth (shown by the limiting line in decompression tables) is exceeded by a diver at that depth.

1.5.21 Float line

A buoyant line connecting the diver to a highly visible float on the surface of the water enabling the approximate location of the diver to be known at all times.

1.5.22 Free flow system

A breathing method used in SSBA diving operations whereby breathing gas enters the full face mask or incompressible helmet in a continuous flow, and is not controlled by a demand gas supply device.

1.5.23 Habitat worker

Any person who is subject to pressure but who does not physically enter the water. The person is not enveloped by water even though that person may be in a housing, a diving chamber that is, in itself, under or in a water environment.

1.5.24 Lazy shot

A rope running vertically from the surface (dive coordinating position) to an attached weight, hanging free and positioned off the bottom or worksite. The rope is marked with depth graduations to facilitate decompression stops at the correct depth.

1.5.25 Lifeline

A line attached to a diver which is capable of being used to haul the diver to the surface.

1.5.26 Limiting line

A line shown in some decompression tables, which indicates time limits (bottom times) beyond which decompression schedules are less safe.

1.5.27 Multiplace compression chamber

A hyperbaric chamber designed for occupancy by more than one person at a time.

1.5.28 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) and comprising all diving carried out—

- (a) as part of a business;
- (b) as a service;
- (c) for research; or
- (d) for profit.

1.5.29 Quick release mechanism

A readily operated mechanism that enables the immediate release, e.g. of diver's equipment, from the secured position by a single operation of one hand, but which is designed to minimize the risk of accidental release.

1.5.30 Repetitive dive

Any dive conducted within 18 h of a previous dive or that has a repetitive factor greater than 1.0 when calculated using DCIEM tables.

1.5.31 Repetitive factor

For DCIEM tables, a figure determined by the repetitive dive group and the length of the surface interval after a dive and used for repetitive diving.

1.5.32 Reserve air supply

That quantity of air that will enable a diver to return safely to the surface from the planned depth of the dive, completing any planned decompression stops.

1.5.33 Residual nitrogen

Nitrogen that is still dissolved in a diver's body tissues after the diver has surfaced.

1.5.34 Saturation

That condition where the person's body tissues are totally saturated with the particular inert element of the breathing medium.

1.5.35 Scientific diving

Diving performed for the purpose of professional scientific research, natural resource management or scientific research as an educational activity.

1.5.36 Self-contained underwater breathing apparatus (SCUBA)

Open-circuit diving equipment which supplies the wearer with breathing gas from cylinders carried by the wearer.

1.5.37 Shall

Indicates that a statement is mandatory.

1.5.38 Shot rope

A rope running vertically from the surface (dive coordinating position) and fixed to the worksite or bottom with a weight or attachment. The rope is marked with depth graduations to facilitate decompression stops at the correct depth. See also Clause 1.5.24 'lazy shot'.

1.5.39 Should

Indicates a recommendation.

1.5.40 Submersible work chamber

A chamber designed to withstand both external and internal pressures, which enables divers to descend and ascend from their submerged workplace at atmospheric pressure or pressures up to the pressures at work depth. The chamber may be able to be mated to deck compression chambers.

1.5.41 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 upon commencement of the diver's next descent.

1.5.42 Surface-supplied breathing apparatus (SSBA)

Diving equipment that supplies breathing gas at the required pressure for the depth, through a diver's hose to a diver from plant at the surface.

1.5.43 Tethered mode (in relation to SCUBA diving)

SCUBA diving in which a diver is secured by a lifeline and tended by a diver's attendant, or is secured to a tended float line.

1.5.44 Therapeutic recompression tables

Tables used for the treatment of decompression injury and other pressure-related injuries.

1.5.45 Transfer-under-pressure (TUP) system

A system for mating a portable compression chamber to another chamber for the purpose of transferring a person under pressure from one chamber to the other.

1.5.46 Visiting scientific diver

A trained, certified visiting diver from another country who performs tasks relevant to scientific diving in his or her own country, who has a current diving medical certification and who is allowed to dive under this Standard during his or her visit (see Section 8).

1.6 RELATIONSHIP WITH LEGISLATION

Attention is drawn to relevant occupational health and safety legislation.

SECTION 2 PERSONNEL FOR DIVING OPERATIONS

2.1 EMPLOYER

The employer shall—

- (a) establish an effective administrative system for the management and control of diving;
- (b) have and maintain a current diving operations manual complying with Appendix B;
- (c) appoint a diving officer in writing (see Clause 2.2); and
- (d) delegate to the diving officer authority and control for all aspects of the organization and administration of diving.

2.2 DIVING OFFICER

The diving officer shall—

- (a) be an experienced diver with the qualifications set out in Paragraph A6 of Appendix A and with experience appropriate to the type of diving operations undertaken;
- (b) be familiar with any legislation and guidelines which may apply to the diving operations, and ensure compliance with this Standard and with the employer's diving operations manual;
- (c) have the power to restrict, prohibit or suspend any diving operations, program or practice which he or she considers unsafe;
- (d) have the power to require such additional safety practices, procedures or equipment as he or she thinks necessary in any diving operation; and
- (e) assess diver's competencies and record the evidence used in the assessment.

NOTE: This Clause outlines the minimum administrative requirement. Employers should establish an administrative system and chain of command commensurate with the number and size of groups or departments engaged in diving within the organization. Examples of systems of organization are given in the UNESCO *Code of Practice for Scientific Diving*.

2.3 DIVE COORDINATOR

2.3.1 Availability

At all times while a diver is in the water or under pressure in a compression chamber, there shall be present a dive coordinator appointed by the diving officer. The dive coordinator shall at all times be responsible for the safe conduct of the diving and shall coordinate and direct the activity of the diving teams.

2.3.2 Qualifications of a dive coordinator

A dive coordinator shall be—

- (a) a trained, experienced diver, qualified in accordance with Paragraph A5 of Appendix A who has experience in the diving techniques which may be required to be used and in the use of equipment and procedures used in the diving operation to be performed;
- (b) appointed in writing by the diving officer to supervise diving operations; and
- (c) trained in the recognition and management of diving emergencies.

2.3.3 Duties of dive coordinators

A dive coordinator shall ensure that all diving operations under supervision are carried out in accordance with this Standard and shall be familiar with any legislative requirements which may be applicable to the diving operations.

2.4 DIVE LEADER

A dive leader is a person in charge of a specific part of a diving operation. A dive leader shall be—

- (a) the dive coordinator or a person appointed by the dive coordinator; or
- (b) a scientific diver or a visiting scientific diver with adequate knowledge and experience of the diving techniques and equipment to be used.

When a dive leader is the person in charge of a single group of divers who are diving in free-swimming SCUBA mode, that person shall take responsibility for any decisions required as the dive proceeds, in consultation with the dive coordinator, and—

- (i) ensure other buddy diver(s) in the group are familiar with the pre-dive plan; and
- (ii) conduct the dive in accordance with this Standard and, as far as possible, in accordance with the pre-dive plan.

2.5 DIVER

2.5.1 Qualifications

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

- (a) is trained, experienced and certified in diving to competency levels appropriate for the diving operation as set out in Appendix A;
- (b) is competent to safely carry out the work required in the operation; and
- (c) has been certified as medically fit to dive in accordance with the requirements of AS/NZS 2299.1 by a medical practitioner appropriately trained in underwater medicine within 12 months prior to diving (see Clause 2.8.1).

The level of training and experience required by a diver considered a competent person is largely dependent upon the type of equipment or diving apparatus being employed and an assessment of the risks likely to be met, e.g. a diver being employed in a situation calling for the use of SCUBA need not be conversant with the use of SSBA.

2.5.2 Duties

A diver shall—

- (a) ensure that he or she is familiar with the pre-dive plan before diving;
- (b) dive in accordance with the pre-dive plan; and
- (c) act as a buddy diver during the dive to others in his or her designated buddy group, unless diving alone in tethered SCUBA mode or alone on SSBA.

Free-swimming buddy divers shall maintain effective two-way communication with each other at all times while in the water and be able to render assistance in case of need.

2.6 DIVER'S ATTENDANT

2.6.1 Availability and knowledge

Whenever a tethered diver goes underwater or is subjected to pressure, the diver shall be attended by a diver's attendant who shall be competent to administer cardiopulmonary resuscitation (CPR) and oxygen resuscitation and have a working knowledge of the following:

- (a) Diving and the requirements of underwater work.
- (b) Signals in use, in particular, the systems of hand and rope signals to be used in the diving operations. Commonly used signals are set out in Appendix C and Appendix D.
- (c) Decompression procedures.
- (d) Diving equipment in use, including ancillary fittings such as pressure gauges, compressors and filters.

The diver's attendant shall not be engaged, other than as specified in Clauses 5.2 or 6.2, in any task other than that of diver's attendant while the diver is in the water or under pressure.

2.6.2 Duties

The diver's attendant, or other person nominated by the dive coordinator, shall—

- (a) record the time of descent and surfacing of each diver;
- (b) maintain a constant vigil during a dive for divers surfacing at a distance from the boat or other dive control position;
- (c) assist in the recovery of divers and all equipment and samples from the water;
- (d) if tending a diver's lifeline or breathing gas hose, maintain the ability to communicate with the diver by means of that lifeline or breathing gas hose;
- (e) give all necessary attention to tending the diver whilst that diver is in the water; and
- (f) if a surface-supply compressor is in use, operate same and ensure that all equipment necessary to provide an adequate supply of air to the diver is in good working order.

2.7 STANDBY DIVER

2.7.1 General

A standby diver shall be present whenever a single diver is underwater in tethered mode, and shall be—

- (a) medically fit to dive in accordance with the requirements of AS/NZS 2299.1 (see Clause 2.8.1);
- (b) a qualified diver (see Clause 2.5.1); and
- (c) located on the surface, dressed and equipped to enable immediate entry into the water for the purpose of providing aid or assistance to a distressed diver.

NOTE: The surface standby diver may perform certain minor duties (e.g. tending the diver's hose or lifeline) provided the safety of the diver in the water is not compromised in any way.

2.7.2 Two divers in the water

Where two divers are in the water at the same time, one may act as standby diver for the other provided that, at all times, both divers have—

- (a) no decompression commitment;

- (b) visual contact with, and direct access to, each other; and
- (c) for SSBA operations, separate air supplies as set out in Clause 4.7.3.2.

2.7.3 Dive profile

The dive profile of the standby diver shall be planned to allow all necessary assistance to be given to a distressed diver without the standby diver incurring a decompression commitment. The only exceptions to this shall be—

- (a) in an emergency; or
- (b) when the depth of the water is such that the standby diver will automatically incur a decompression commitment.

2.8 SUPERVISION OF HEALTH

2.8.1 Certification by a medical practitioner

No person shall dive or be subjected to pressure unless that person has been examined and certified as fit in accordance with AS/NZS 2299.1. A certificate of fitness to dive shall have been issued by a medical practitioner with training in underwater medicine within the 12 months prior to diving.

NOTE: An increase in the frequency of examinations in individual cases is at the discretion of the medical practitioner.

2.8.2 Fitness to dive

All divers involved in diving shall ensure that they are fit to dive. Fitness should be maintained by exercise and regular diving. Any noticeable variation in normal feeling of health and fitness should be immediately reported to the dive leader, and to a medical practitioner if the variation persists.

Where a diver has not dived for a period of time exceeding six months, the diver shall carry out a check out dive or program of dives with the diving officer or the diving officer's delegate qualified to undertake such an evaluation. The nature of the checkout program is at the discretion of the diving officer and should consider the diver's previous training and experience, the time lapsed since the last scientific dive, the profile of the proposed dive, and the nature of the dive site and work to be undertaken on the proposed dive.

2.8.3 Intoxicants

Diving should not be undertaken while the diver is under the influence of any intoxicants, within 8 h of consuming any intoxicants or if the diver is under the influence of any drugs that may impair his or her mental or physical capacities.

2.9 FIRST AID FOR DIVING TEAMS

At every diving operation there shall be sufficient first aid personnel to administer first aid to any reasonably foreseeable emergency.

All divers and attendants should be trained in first aid so that, as a minimum, they are able to—

- (a) control bleeding;
- (b) administer 100% oxygen to spontaneously breathing patients and oxygen-enriched resuscitation to non-breathing patients using the oxygen resuscitation equipment at the dive site (as specified in Clause 3.13);
- (c) care for an unconscious patient; and
- (d) carry out cardiopulmonary resuscitation.

NOTES:

- 1 The above requirements are usually met by a first aid course leading to certification, incorporating or supplemented by an oxygen administration course.
- 2 While it is highly desirable for all personnel to have training in first aid, it may in some circumstances be possible to make adequate provision for the delivery of emergency first aid with not all personnel being trained, provided that no less than two persons are trained and available to ensure first aid will be available if required.

2.10 RECORDS**2.10.1 Employer's record of divers**

The employer shall maintain records of all divers involved in the organization's diving operations and records of the evidence used in assessing the diver's competencies and fitness to dive.

2.10.2 Diver's record

All divers shall keep and maintain a permanent record of all diving undertaken for the duration of the diver's working life.

This permanent record of diving shall include—

- (a) the diver's photograph;
- (b) next of kin information;
- (c) diver's name, address, date of birth and signature;
- (d) a record of medical examinations conducted for the purpose of occupational diving;
- (e) a record of diving activity undertaken; and
- (f) a record of accidents and incidents including decompression treatment(s).

The diver's record of diving covering at least the previous seven day's diving activity shall be available to the diving officer.

The permanent record of diving shall be presented at each diving medical examination.

The diver's record of dive (including a brief summary of any incidents or accidents) should be entered into this permanent record of diving at the completion of each dive, and signed by the dive coordinator for verification.

The permanent record of diving should have each page consecutively numbered and entries should be made in ink.

NOTES:

- 1 A typical diver's record of dive is shown in Appendix E.
- 2 The diver's permanent record of diving usually takes the form of a logbook.

2.10.3 Employer's record of dives

The employer shall ensure that for each diving operation, a record containing the following minimum information is prepared:

- (a) Date and time of diving operation.
- (b) Location of diving operation.
- (c) Name of dive coordinator.
- (d) Names of divers and standby divers.
- (e) Nature of task(s).
- (f) Maximum depth of the dive.

- (g) Time left surface, time reached bottom and time left bottom (for each diver).
- (h) Duration of dive, dive profile and breathing gases for each diver.
- (i) Decompression schedule utilized for each diver (where applicable).
- (j) Details of incidents and accidents.
- (k) Diving equipment used, including content of cylinders at beginning and end of dives for dives on cylinders.
- (l) All other relevant details.
- (m) Dive coordinator's signature.

NOTE: A typical employer's record of the diving operation is shown in Appendix F.

2.10.4 Maintenance record

Where tests are carried out, e.g. for breathing gas purity, records of test results, together with identification of the breathing gas supply or air compressor, shall be maintained for a minimum period of 7 years.

SECTION 3 ORGANIZATION AND PLANNING

3.1 GENERAL

Diving needs planning and foresight. Bottom time is at a premium. The diver(s) shall be placed on the job under the optimum conditions of knowledge, equipment, ability, safety, and freedom from distractions. Topside assistance shall be well organized and capable. Time spent in determining conditions under which the diver will work should result in greater efficiency once the work is commenced.

Failure to consider any item of available information during the planning stage may jeopardize the lives of divers or result in failure of the diving operation.

The employer's diving operations manual (see Clause 2.1 and Appendix B) should be consulted during all diving planning.

A written dive proposal shall be produced (see Clause 3.3). When approved, the dive proposal should form the basis of the pre-dive plan and risk assessment (see Clause 3.4).

3.2 DIVE SITE REGISTRATION AND RISK ASSESSMENT

At the beginning of a scientific program, or as new dive sites are used during a program, a site shall be registered with the diving officer. During field operations the dive coordinator may register dive sites. The registration should include the results of a general risk assessment of the site and the type of work proposed, along with emergency numbers, emergency response plans, exposure, isolation, known or anticipated water depths and tidal currents, and other special hazards as appropriate. Travel aspects, such as altitude exposure in travelling to or from a site, should also be included. Risk assessments should be reviewed as divers gain more experience at dive sites.

3.3 DIVE PROPOSAL

Before every diving operation, the dive coordinator shall prepare in writing the dive proposal and shall submit that proposal to the diving officer for approval.

The dive proposal shall—

- (a) specify as far as possible the intended location, date, time, depth and duration of every proposed dive;
- (b) specify the breathing gas supply appropriate for the dive (see Clause 3.5);
- (c) specify the equipment to be used (see Clause 3.5 and Section 4);
- (d) give consideration to any need to travel at altitude before or after diving (see Clause 3.14);
- (e) provide for emergencies as described in Clauses 3.12, 3.13 and 3.15;
- (f) identify appropriate responses to mitigate risk and respond to hazards as identified in the dive site registration and risk assessment (see Clause 3.2); and
- (g) identify the make up of the dive team and their duties.

The use of restricted scientific divers shall not compromise the safety of the diving operation. Dive planning shall ensure the operation of the dive team and emergency capabilities are adequately assessed and covered. This may involve the restricted scientific divers being supernumerary to the minimum dive team.

A copy of each approved dive proposal shall be lodged with and retained by the employer as part of the diving records (see Clause 2.10.3).

3.4 ON SITE PRE-DIVE PLAN AND RISK ASSESSMENT

At the dive site before every dive, the dive coordinator, divers, divers' attendants and any non-diving support personnel shall discuss in detail and agree upon the pre-dive plan and update the risk assessment as appropriate.

NOTES:

- 1 Guidance on carrying out risk assessments for diving operations is provided in Appendix G.
- 2 Dive planning of an underwater project needs to take into account physiological and practical limitations and scientific objectives. Realistic planning is best carried out by persons with both scientific and diving experience.

The pre-dive plan shall include—

- (a) the location of the dive;
- (b) consideration of surface and underwater conditions and hazards (see Clauses 3.6 and 3.7);
- (c) the maximum depth (see Clause 3.8) and bottom time of the dive;
- (d) thermal protection required (see Clause 3.9);
- (e) the tasks of all members of the diving team;
- (f) residual inert gas status of dive team members;
- (g) decompression schedules, if required;
- (h) the breathing gas supply appropriate for the dive (see Clause 3.5); and
- (i) emergency procedures to be followed in the event of an equipment or system malfunction (see Clause 3.12) or an accident (see Clauses 3.12 and 3.13).

NOTE: Dive planning of an underwater project needs to take into account physiological and practical limitations and scientific objectives; realistic planning is best carried out by persons with both scientific and diving experience.

3.5 SELECTION OF BREATHING APPARATUS

3.5.1 General

The decision as to which type of breathing apparatus is appropriate for a given type of diving operation shall be made after consideration of the competency of the diver, the type of work to be done by the diver(s), the equipment required, the conditions under which the diver(s) will work, and the inherent risks and limitations of each type of breathing apparatus.

3.5.2 Factors to consider when selecting breathing apparatus

The decision as to which type of equipment is appropriate for a given diving operation should be taken after consideration of the following:

- (a) Planning a SCUBA diving operation requires assessment of the likely gas consumption for the operation. This can vary greatly, depending on the diver, the task and the environment. As depth increases, it becomes increasingly difficult to make reliable assessments of gas consumption under varying work conditions and, therefore, of the amount of gas left in the cylinders. Specialized equipment to overcome this problem is available.
- (b) Surface-supplied systems do not require the same extent of gas consumption assessment as the supply is usually not limited and these systems are therefore more applicable to deep dives or dives requiring hard work.

3.6 SURFACE CONDITIONS

In planning a diving operation, careful consideration shall be given to the surface conditions that will be encountered at the scene of the operation. These conditions include the state of the sea, weather, visibility, tide, currents, water temperature, presence of ships or other craft, and any other surface conditions that could affect the operation.

Diving operations shall not be undertaken in rough seas, unusual tides or currents, or other adverse conditions unless the dive coordinator, dive leader and the diver consider that the diver's safety will not be jeopardized.

3.7 IN-WATER CONDITIONS

Careful consideration shall be given to the in-water conditions likely to be encountered before diving operations commence. Such conditions include visibility, presence of contaminants, obstructions, dangerous marine life, thermoclines, pump intakes, pressure differentials and currents of 0.5 knots or greater.

3.8 DEPTHS

3.8.1 Depth of water

Before diving operations are commenced at any site, the maximum depth of water at the site and the maximum possible depth to which the diver could be exposed shall be ascertained by reliable means.

3.8.2 Depth limit

The maximum depth of diving conducted to this Standard shall be 39 m in the case of no-decompression diving and 30 m for diving that requires decompression.

3.8.3 Precautions for deep diving

No dive shall be carried out at depths greater than 30 m unless—

- (a) each diver, including standby divers (see Clause 2.7), has undertaken the appropriate training (see Appendix A);
- (b) each diver carries an independent reserve breathing gas supply;
- (c) each diver has undertaken a schedule of work-up dives, appropriate to the depth and conditions;
- (d) appropriate facilities and equipment including support vessels, shot lines, buoys, ropes, spare SCUBA sets (for SCUBA dives) and reserve breathing gas supplies are in use during the dive; and
- (e) arrangements are in place in accordance with Clause 3.15 for emergency recompression of any diver showing signs of decompression illness.

3.9 WATER TEMPERATURES

The temperature of the water at the dive site shall be ascertained and suitable equipment shall be used to maintain the diver at a safe temperature.

3.10 HAZARDOUS CONDITIONS

The following conditions are potentially hazardous and require special training, precautions and equipment:

- (a) Diving using dry suits.
- (b) Being towed on a 'manta-board'.

- (c) Diving in zero or low visibility.
- (d) Diving at night (see Clause 3.11).
- (e) Deep diving (see Clause 3.8).
- (f) Diving in caves, enclosed spaces, or places where there is danger of entanglement.
- (g) Blue water diving (diving in open water where the bottom is beyond permitted diving depth).
- (h) Decompression diving (requiring the use of decompression schedules, see Clause 3.14).
- (i) Diving in surf, strong currents (in excess of 1 knot or 55 cm/s), or heavy seas.
- (j) Other conditions that present unusual hazards.

The dive coordinator shall ensure that every diver diving in the conditions set out in Items (a) to (j) has the appropriate training and equipment.

NOTE: Hazardous conditions for diving vary widely throughout Australia and New Zealand and require that additional training, equipment, operational procedures and emergency procedures (Clause 3.13) be specifically developed by employers according to location and environment. This Standard specifies only minimal requirements for commonly encountered hazards.

3.11 DIVING AT NIGHT

During every night diving operation the dive site, including the entry and exit points of a shore dive, shall be adequately and distinctively illuminated. Every diver shall carry at least two lights, one of which may be a chemically-activated light stick.

NOTE: Consideration should be given to the use of other safety measures, according to circumstances. They include tethered mode diving, and the use of emergency lighting such as the chemically-activated light stick attached to the diver and to one or more buoys at the dive site.

3.12 COMMUNICATIONS

A communication system appropriate to the task and situation shall be established between any tethered diver(s) and the surface support position. Voice communications should be considered.

When divers are operating in free-swimming SCUBA mode in circumstances in which there is surface support, there shall be a means to recall the divers to the surface. Through water voice communications should be considered.

The dive coordinator shall ensure that at or close to every dive site there are adequate means of immediate communication in the event of an emergency.

3.13 FIRST AID, MEDICAL AND EMERGENCY SERVICES

3.13.1 General

In all instances, an assessment should be made of the potential hazards of each diving operation. Appropriate first aid equipment, training or other resources should be made available to cope with any reasonably foreseeable emergency. Guidance should be sought from relevant occupational first aid codes of practice, from diving medical advisers or from the relevant regulatory authority where applicable.

Equipment should be chosen taking into account the first aid training and experience of dive team members. Provision should also be made for airway suction and other facilities required by any regulatory authority.

3.13.2 Oxygen resuscitation equipment

Oxygen resuscitation equipment shall be available at the dive site for immediate use if required.

The oxygen equipment shall be capable of providing an inspired oxygen concentration of as close as practical to 100% to a patient who is breathing spontaneously and capable of providing an inspired oxygen concentration in excess of 50% to a non-breathing patient. Sufficient oxygen shall be available to supply the resuscitator taking into account the location of the dive site and access to medical facilities.

3.13.3 Emergency services

The dive coordinator shall identify the location of the nearest emergency medical and hyperbaric facility and shall make appropriate plans for emergency notification of an accident, and transport of an injured person to such facility.

3.14 DECOMPRESSION DIVING

3.14.1 Decompression schedules

All SSBA and SCUBA diving, including repetitive diving, shall be carried out in accordance with widely-recognized and industry-approved decompression tables or a dive computer following the guidelines set by the manufacturer. The decompression schedule followed shall be at least as conservative as the current DCIEM decompression tables.

3.14.2 Decompression diving deeper than 30 m

Decompression diving for dives in excess of 30 m shall be conducted in accordance with AS/NZS 2299.1.

3.14.3 Decompression diving to depths up to and including 30 m

No dive shall be carried out for a period of time that requires a decompression schedule unless—

- (a) each diver, including standby divers (see Clause 2.7), has undertaken the appropriate training (see Appendix A);
- (b) each diver carries an independent reserve breathing gas supply;
- (c) each diver has undertaken a schedule of work-up dives, appropriate to the depth and conditions;
- (d) appropriate facilities and equipment including support vessels, shot lines, buoys, ropes, spare SCUBA sets (for SCUBA dives) and reserve breathing gas supplies are in use during the dive; and
- (e) arrangements are in place in accordance with Clause 3.15 for emergency recompression of any diver showing signs of decompression illness.

When mandatory decompression stops are required to be carried out in the water the following procedures shall be used:

- (i) An accurately marked and adequately weighted shot line shall be used for every decompression stop. The diver shall be on the shot line at all times and shall record the depth and duration of all stops.
- (ii) If the diver breaks the surface before completing the time required for each stop, then the procedure outlined in the DCIEM decompression tables shall be followed.
- (iii) Voice communications shall be used.

3.14.4 Precautionary decompression stops

Where no-decompression diving is undertaken, divers should carry out a precautionary decompression stop at the end of each dive using the schedule that would be applicable if they had just exceeded the no-decompression limits for the dive. If precautionary decompression stops are to be carried out, they should be included in the dive plan.

3.15 COMPRESSION CHAMBER SUPPORT OF DIVING

3.15.1 Availability of compression (recompression) chamber support

Emergency recompression chamber support shall be organized for all diving operations. This may involve a chamber on site or at a distance and the chamber may or may not be dedicated to support of the diving operation.

3.15.2 Requirement for an on site chamber

An operational recompression chamber shall be located on site when—

- (a) decompression diving is undertaken;
- (b) free or buoyant ascent training is being conducted;
- (c) diving exceeds the depth/time limits given in Column A of Table 3.1; or
- (d) the nature of the work or local conditions creates a significant risk of emergency ascent.

NOTES:

- 1 This Standard does not cover decompression diving to depths greater than 30 m. Any such dives should be carried out in accordance with the requirements of AS/NZS 2299.1.
- 2 'On site' means at the dive control position or, if this is impossible, close enough to the dive control position to ensure that a diver could be recompressed within the chamber within 5 min of completing the ascent from the dive.

3.15.3 Recompression chamber type, staffing and operation

For on site chambers and chambers dedicated for diving support, the specifications of the recompression chamber, its staffing and operation and the qualifications of operators shall comply with the requirements in AS/NZS 2299.1. Other chambers considered for diving support shall be multiplace, twin lock chambers within medical facilities which have operational capability and availability to provide emergency diver treatment.

NOTE: AS/NZS 2299.1 also provides guidance on recognition and treatment of decompression illness.

3.15.4 Diving without a dive site chamber

The time of availability of recompression shall be estimated realistically in accordance with arrangements made in Clauses 3.4 and 3.13.3. All diving undertaken without on site compression chamber support should be low risk diving with controlled ascents and routine safety stops performed. Where multiple dives are undertaken on one day, residual nitrogen times from previous dives shall be taken into account in calculating the time allowable for a subsequent dive. Any significant risk-increasing factor (e.g. cold water or hard work) should lead to further shortening of dive times or extra safety time, determined by moving an additional one or two time or depth levels up the DCIEM tables or, for dives to 12 m or less, up Table 3.1. Divers should carry out a precautionary decompression stop at the end of each dive in accordance with Clause 3.14.4.