Part 4. Bell Diving

Part of the preface, where it differs from the preface of Part 3, parts of Section 1 and 2 where they differ from Part 3, are reproduced below.

This draft is particularly related to the further training of experienced air divers and underwater workers to permit them to operate safely and competently as bellmen and lock-out divers. Such training and accreditation is the minimum required by regulatory authorities who are responsible for the control of deep diving off-shore, eg. oil and gas exploration.

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard specifies the training activities and terminal objectives required for the training and further accreditation of experienced air divers to operate safely and competently as bellmen and lock-out divers.

1.2 PURPOSE AND TERMINAL OBJECTIVES.

1.2.1 Purpose. The purpose of this standard is to describe the organizational and syllabus requirements necessary to train experienced air divers to operate safely and competently as bellmen and lock-out divers.

1.2.2 Terminal Objectives. Terminal objectives have been grouped under four headings (Tables) in this standard as follows:

Table 2.1	*Deck Compression Chamber Operations*
Table 2.2	*Diving Bell Operations*
Table 2.3	*Diving Theory, Physiology and First Aid*
Table 2.4	*Relevant Legislation and Guidance.*

(c) Diving bell operations

(i) Familiarization training. Familiarization training must be given in shallow depths. The instructor or experienced bell diver must be in the bell until he is satisfied the trainee can act safely and competently as a bellman and lock-out diver in shallow depths before carrying out dives below 50 m.

The following minimum number of shallow training dives must be achieved:

A. Twenty-five bell runs with lock outs
B. Act as a bellman for 25 runs with lock-outs
C. Complete five simulated rescues of an incapacitated diver.

(ii) Training below 50 m. The trainee must complete safely and competently a minimum of four bounce dives acting as a bellman and lock-out diver at progressive depths from 50 m to 100 m. It is not essential for an instructor or experienced bell diver to be in the bell provided that the trainee has satisfied the requirements in (i) above.

NOTE: Where, due to seasonal conditions or weather, depths of 100 m are not available at the scheduled time of the 100 m training dives, the training school must notify the Regulatory Authority of the maximum depth of water available at that time and seek approval prior to diving to any alternative depth.

(iii) Task training. Trainees must complete underwater rescues from 50 m to 100 m to give representative in-water times and experience of working at these depths. The tasks may be carried out during the diving bell training, ie. (ii) above.

(iv) Saturation diving. Trainees must be exposed to saturation conditions for a minimum of 36 hours including decompression, and should whenever possible complete a lock-out dive under these conditions. Two excursions from saturation to a depth greater than 50 m can be counted as two of the bounce dives.

1.5 SELECTION CRITERIA

The trainee should, as a minimum -

(b) be a competent commercial air diver approved to AS XXXX, Part 3 with at least 12 months' experience as a commercial diver or have experience acceptable to the relevant Regulatory Authority;
(d) be able to understand written and verbal communications and be able to communicate easily with one another. This is particularly important where trainees or instructors are of differing nationalities.

DECOMPRESSION DIVING AND BONE NECROSIS

Dr RI McCallum of the Department of Occupational Health and Hygiene, The University of Newcastle-Upon-Tyne, has responded to the article "Decompression Diving can cause bone damage" which appeared in the April 1983 Barologia newsletter. The following information is of interest:

"1. The great majority of bone lesions are quite symptomless and do not involve joints and are therefore not disabling.
"2. Only a small minority of commercial divers have bone damage to joints and this is rare in the hip joint which is the most disabling area for joint damage to appear.
"3. We have not found bone damage at all in commercial divers who have not gone deeper than 30 metres. We have not found this condition in sport divers and indeed I think it is most unlikely."

RI McCallum
Reprinted from *BAROLOGIA* Newsletter, October 1983.

SECTION 2. TABLES OF TERMINAL OBJECTIVES AND TRAINING TOPICS

Terminal objectives	*Training Objectives*
The overall standard to be achieved by the end of the training (to be able to -)	*Specific topics to be achieved during the training to meet the requirements of the terminal objectives.*

TABLE 2.1

DECK COMPRESSION CHAMBER OPERATIONS

2.1.1	*Outline the working of built-in breathing and dump systems and carry out user maintenance of the systems under supervision.*	*- Assess masks for proper function.* *- Detect wear or damage of equipment.* *- Position valves to ensure correct functioning.* *- Select appropriate gas supply on panel and chamber.* *- Carry out user maintenance and replacement of worn and damaged parts under supervision.*
2.1.2	*Outline the working and purposes of valves, non-return valves, regulators, gauges and connections and carry out user maintenance under supervision.*	*- Explain the purpose and operation of gas systems to the chamber including the functions of all components.* *- Carry out user maintenance under supervision.*
2.1.3	*Outline principles and the use of oxygen and carbon dioxide monitors and where applicable calibrate them accurately under working conditions.*	*- Explain the principles of gas monitoring. Accurately calibrate and interpret readings of oxygen and carbon dioxide under working conditions.*
2.2.4	*Outline the principles of carbon dioxide scrubber systems and carry out user maintenance under supervision.*	*- Explain the need for carbon dioxide absorbent. Assess whether equipment is functioning correctly.* *Change carbon dioxide absorbent canister at appropriate times and charge canister correctly under supervision.*
2.1.5	*Outline the effect of impurities in gases and the need for purity.*	*- Explain the effects of impurities and possible methods of entry of impurities into -* *- the environment of a diving system;* *- a diver's breathing gas.* *- Explain the symptoms of carbon dioxide and oxygen poisoning and methods of prevention and control.*
2.1.6	*Outline the methods for cleaning gas systems to oxygen standard.*	*- Explain effects of oil and grease in contact with high pressure oxygen.* *Explain the correct use of appropriate cleaning methods and materials to avoid oil and grease contamination.* *- Explain the need for strict observance of the gas handling rules.*
2.1.7	*Outline the reason for oxygen cleanness.*	*- Explain the effects of a high pressure supply of oxygen in contact with a combustible material.* *- Explain procedures to prevent accidental contamination and appropriate methods of cleaning contaminated components.*
2.1.8	*Operate the built-in breathing system.*	*- Select correct gas mode during decompression oxygen or oxygen/helium.* *- Operate appropriate valves to ensure correct gas and built-in breathing system functions.* *- Supply oxygen or oxygen/helium to the built-in breathing system from the control panel.*

2.1.9	*Monitor the chamber for depth, temperature, humidity, oxygen level and carbon dioxide level and partial pressure limits.*	*- Explain the maximum and minimum permissible partial pressure limit of oxygen and carbon dioxide.* *- Monitor depth, temperature, humidity and oxygen and carbon dioxide levels within a system during a diving operation.*
2.1.10	*Outline the fire precautions and methods of dealing with fires inside and outside compression cheers.*	*- Explain reasons why only certain materials can be permitted inside a diving system.* *- Explain the operation and correct location of fire extinguishers.* *- Assess cheer cleanness before use.* *- Carry out chamber evacuation and isolation procedures from inside the chamber.* *- Explain procedures to be carried out by the surface team.*
2.1.11	*Carry out a pre-dive and post-dive check of a compression chamber under supervision using a check list.*	*- Explain the need for and carry out under supervision the pre-dive and pest-dive checks of a diving system using a check list.*
2.1.12	*Explain the working and safety features and operate a hyperbaric sanitary system under working conditions.*	*- Explain the working of the system and the need for safety features.* *- Operate system under working conditions.*
2.1.13	*Explain the working of and, under supervision, use a medical lock on a pressurized diving system.*	*- Explain the consequences of misuse of the hand-lock.* *- Detect malfunctions of valves and if necessary take appropriate safety actions under supervision.* *- Assess correct functioning of valves, dogs, O-seals and seal facings.* *- Carry out routine maintenance of seals.*
2.1.14	*Operate and communicate, using helium unscrambler, telephone emergency signals and other communication systems.*	*- Operate primary and stand-by communication systems using helium unscrambler.* *- Practice emergency communication procedures.*
2.2.15	*Outline the reasons for and nature of emergency procedure, eg. contingency plan for chamber emergencies.*	*- Explain possible emergencies which may occur in chambers.* *- Explain procedures which can be used for example in event of fire, pollution, loss of communications, etc.*
2.1.16	*Apply compression and decompression schedules under supervision and outline abort procedures and therapeutic decompression schedules.*	*- Calculate correct gas mixture and depth for each stage of bounce and saturation dives.* *- Compress and decompress a diving system under supervision.* *- Explain abort procedures and circumstances in which procedures would be used.* *- Explain therapeutic schedules to be applied during or after exposure to pressure.*
2.1.17	*Make an accurate record of an actual dive.*	*- Maintain a log throughout a bounce and a saturation dive.*
2.1.18	*Act as an effective member of the surface team in support of bounce and saturation diving techniques.*	*- Act as an effective member of the surface team supporting bounce and saturation diving operations using all the bell handling, life support, and communication systems.* *- Act as an effective member of the surface team in providing the daily requirements of divers in saturation conditions.*
2.1.19	*Act as an effective member of a diving team under bounce and saturation conditions.*	*- Complete all objectives in this Table to the required standards.*

TABLE 2.2

DIVING BELL OPERATIONS

2.2.1	*Outline the principles of hyperbaric oxygen and carbon dioxide monitors and calibrate them in the diving bell.*	*- Explain the principles of both oxygen and carbon dioxide analysers.* *- Use and interpret the readings of oxygen and carbon dioxide analysers under working conditions.*
2.2.2	*Demonstrate the ability to put diving gases on line to the diving bell, diver's breathing apparatus and mating trunk.*	*- Explain the purpose and operation of gas systems from the control van to the bell and the function of all components.* *- Operate the systems under working conditions.*
2.2.3	*Outline the working of the bell scrubber system.*	*- Explain the need for carbon dioxide extraction.* *- Analyse the bell atmosphere for carbon dioxide content.* *- Carry out canister replacement when necessary.* *- Understand permissible limits of carbon dioxide.* *- Carry out procedure for flushing of bell when necessary.*
2.2.4	*Describe the diver's heating systems (external body heating and respiratory gas heating).*	*- Explain the need for and operation of heating systems.* *- Explain action to be taken if failure occurs in heating systems.*
2.2.5	*Use main and secondary communication systems.*	*- Operate primary and back-up communication systems during bounce and saturation diving operations.*
2.2.6	*Describe methods of ballasting and ballast-release systems.*	*- Explain the purpose of ballasting procedures for slipping the ballast in emergencies.*
2.2.7	*Describe the working of, and operate under supervision, a handling system for diving bell operations.*	*- Explain the working of, and operate, a handling system under supervision.* *- Explain safety precautions and back-up facilities available in event of main power system failure.*
2.2.8	*Carry out pre-dive and post-dive checks of the diving bell using a check list.*	*- Explain the need for and carry out under supervision the pre-dive and post-dive checks of a diving bell using a check list.*
2.2.9	*Outline methods of emergency bell recovery.*	*- Explain possible circumstances in which the loss of a diving bell may occur.* *- Explain some recovery methods available for different emergencies.* *- Explain the actions to be taken by the surface and diving teams in emergencies.*
2.2.10	*Demonstrate emergency routines including the rescue of an incapacitated diver.*	*- Prepare the bell for emergency chamber evacuation.* *- Use built-in breathing systems in simulated contaminated atmospheres.* *- Carry out simulated rescue of unconscious diver with the bell partially flooded.* *- Carry out expired air method of resuscitation and external cardiac massage in bell.*
2.2.11	*Act safely and competently as a bellman and lock-out diver.*	*- Carry out duties of bellman in tendering and handling locked-out divers.* *- Analyse and control bell environment gas mixture.* *- Explain operation of regular and emergency scrubber systems.* *- Operate diver's heating system.* *- Operate all internal controls.* *- Explain emergency bell decompression methods and metabolic oxygen make-up.*

		- Explain emergency procedures for loss of communications, gas supply, umbilical and ballast. *- Complete minimum diving requirements specified in Clause 1.2.3(c).*
2.2.12	*Act as an effective member of the surface team in support of bell diving and transfer under pressure procedures.*	*- Complete all objectives in this Table to the required standards.*

APPENDIX A

EXAMPLE OF TRAINING SYLLABUS
Bell Diving Training Course - Diving Requirements and Outline Syllabus

(Operated by Underwater Training Centre,
Fort William, Inverness-shire, Scotland).

DRAFTING NOTE: Comment on alternative syllabus suitable for use in Australia, acceptable to Australian authorities and, hopefully European authorities, is especially requested.

1. Diving requirements

To achieve the required standard the trainee must complete the following diving programme:

1 Bell familiarisation training in shallow depths.
Minimum requirements
25 lock-outs

25 dives acting as a bellman

5 simulated rescues of an incapacitated diver.

2 Dives from 50 to 100 metres

1 50 metre bell bounce dive on air
1 55 metre saturation dive with excursion to 75 metres
1 75 metre bell bounce dive
1 100 metre bell bounce dive
1 simulated rescue of an incapacitated diver on a bell dive below 50 metres.

12 trainees per course.

The SF/17 Committee is to be congratulated on its efforts. The sad toll of accidents and deaths in the North Sea prompted the UK regulations as it was evident that many of the problems were due to inadequate training. It is good to see the drive for world wide standards shown in this draft. The UK regulations have proved their worth and prescribe the obvious standard of training and competence for Australia to aim for. One problem faced by Australian diving schools is finding 100m water depth which can be used safely all the year round. Without this depth divers cannot be trained to the UK standard for Bell Diving.

A study of the various training programmes shows how much extra time and effort goes into producing a commercial diver compared to producing a sports diver. Even the part-time diving archaeologist, researcher or scientific observer has to do a 20 day course. With the minimum underwater training requirements of 15 hours these people should be safe underwater even with distractions of a definite task.

An Australian Standard is a guide book for good practice, not a legal obligation in its own right. Let us hope that the Commonwealth and all the State and Territory governments will soon pass legislation making the training outlined in the various parts of this Draft Standard obligatory for all divers who are paid to dive. But that alone will not prevent people killing themselves in such ways as diving deep on air in a cold, fresh water lake in Tasmania to do a job on the cheap. Heliox diving and hot water suits were needed to recover the body of that young professional diver. He did not know enough, or was foolish enough to ignore what he knew, to plan that dive safely. With the programme outlined in the Draft Standard that diver's successors will know the risks and hopefully will not be willing to cut corners on safety to make money. Their employers will also know what training the divers should have done to face the tasks before them.

The Standards Association invites comments on the draft. Should you wish to comment you can obtain a copy of the draft from:

The Standards Association of Australia
191 Royal Parade
Parkville VIC 3052

The Association also has offices in the other capital cities.

NSW WATER SAFETY WEEK

REQUIEM AND FLAG

The theme of the 1983 Water Safety Week was Diving Safety. A symposium on this theme was held at the Sydney Opera House on September 28th and 29th. Among the speakers were representatives of the RAN, the Police Divers, the Maritime Services Board and both FAUI and PADI. There were talks on the lessons from diving fatalities and the investigation of fatalities, the use of helicopters for the rapid transfer of the victims and the contrast in the speed of reaching hospital facilities between a road traffic accident and a person suffering a suspected diving-related problem. Of particular impact were two films and a reminder of the present status of the "Divers Down" flag.

The first film to be shown was titled "Requiem for a Diver", a well scripted and played quick review of the common faults using a variety of Royal Navy (and other) equipment. It has a message for every diver and contains many of the basic safety lessons which will be forever relevant. It was made years ago but has a timeless ring of truth. See it if you get the chance.

This excellent RN 16 mm optical sound film is available on loan from

Dr John Knight,
80 Wellington Parade,
EAST MELBOURNE VIC 3002.

The borrower is responsible for transport charges and replacement insurance ($600).

Colin Hodson presented the second film, the record of teaching some disabled persons to dive. This project continues and will be reported on further when a progress report is produced. The project has encountered many problems, for participants are people with personalities and not a single entity of "the disabled" (a fact noted previously in this Journal).

Of most immediate and practical importance to divers were the comments of Captain Stacey of the Maritime Services Board of NSW. He drew attention to the benefits and limitations of the Flag A, flown, one hopes, by all boats from which divers are operating. He reminded his listeners that there are regulations about diving in tideways and shipping channels and that the flag is ONLY relevant to vessels. Until and unless new regulations are brought out a diver not operating from a boat is NOT protected by the regulations, though a flag will indicate to vessels his presence. The balance of benefits and limitations which would ensue from Flag A being required for all diving in all situations are matters which need thorough consideration.

It is of some interest to recall that Flag A has been the only "Diver Down" warning flag officially sanctioned in the UK and Australia for many years. The change to Flag A occurred in the UK between 1966 and 1970, the date of change in Australia being similar. There had been a period from 1962 in Australia when Flags 'H' and 'D' had replaced the use of the red and white diving flag then, and still, in use in the USA. Flag 'Alpha' received international acceptance in 1981 and is expected soon to become recognised for its diving connotation in the USA also, though people there say that it will take a long time to educate those in charge of vessels.

A formal declaration of dive shop policy on the hire of equipment was made public in a document agreed to and signed on behalf of FAUI, PADI and NAUI (in April 1983). Their members agreed to supply only those divers able to produce documentary evidence of their training. In the commercial diving world, too, certificates of competency are now a requirement. Thus is diving safety improved.

MEMBERSHIP OF SPUMS

Members pay $20.00 yearly and Associate Members $15.00. Associated Membership is available for those neither medically qualified nor engaged in hyperbaric or underwater related research. Membership entitles attendance at meetings and the Annual Scientific Conference and receipt of the Journal/Newsletter.

Anyone interested in joining SPUMS should write to:

Dr Chris Acott
Secretary of SPUMS
Rockhampton Base Hospital,
Rockhampton QLD 4700

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Department of Anaesthesia
The Prince Henry Hospital
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