

CODE OF PRACTICE

Safety and Health at Work for Industrial Diving



Occupational Safety and Health Branch
Labour Department



CODE OF PRACTICE

**Safety and Health at Work
for Industrial Diving**

**Occupational Safety and Health Branch
Labour Department
January 1998**

This Code of Practice is prepared by
the Occupational Safety and Health Branch,
Labour Department

This edition January 1998

This Code of Practice is issued free of charge and can be obtained from offices of the Occupational Safety and Health Branch, Labour Department. It can also be downloaded from website of the Labour Department at <http://www.labour.gov.hk/eng/public/os/diving.exe>. Addresses and telephone numbers of the offices can be found in website of the Department at <http://www.labour.gov.hk/eng/tele/osh.htm>.

This Code of Practice may be freely reproduced except for advertising, endorsement or commercial purposes. Please acknowledge the source as “Code of Practice: Safety and Health at Work for Industrial Diving”, published by the Labour Department.

▶ CONTENTS

▶	1. INTRODUCTION	
	1.1 Purpose	7
	1.2 Scope	8
<hr/>		
▶	2. INTERPRETATION	9
<hr/>		
▶	3. RESPONSIBILITIES	
	3.1 General	12
	3.2 Responsibilities of Diving Contractor	12
	3.3 Responsibilities of Diving Supervisor	14
	3.4 Responsibilities of Diver	15
<hr/>		
▶	4. DIVING MODES AND COMPETENCE OF DIVERS	
	4.1 Depth Limit of Air Diving	17
	4.2 Diving Modes	17
	4.3 Competence of Divers	19
<hr/>		
▶	5. MEDICAL FITNESS OF DIVER	
	5.1 Certificate of Medical Fitness to Dive	20
	5.2 Physical Fitness of Divers	20
<hr/>		
▶	6. PLANNING AND DIVING RULES	
	6.1 Planning and Assessment	22
	6.2 Diving Rules	23
<hr/>		
▶	7. DIVING SUPPORT	
	7.1 Diving Team	24
	7.2 Breathing Apparatus and Gas Supply	26
	7.3 Air Supply from Compressor	26
	7.4 Cylinder Gas	27
	7.5 Lifeline	28
	7.6 Communication	29



▶	8. GENERAL SAFE PRACTICES	
	8.1 Pre-dive Practices	31
	8.2 During-dive Practices	32
	8.3 Post-dive Practices	33
	8.4 Equipment Examination and Testing	34
	8.5 Protection from Cold	35
	8.6 Diving in Culverts, in Locks, on or near Outfalls and in Pipelines	35
<hr/>		
▶	9. DECOMPRESSION	
	9.1 Methods of Decompression	37
	9.2 Provision of Recompression Chamber	37
	9.3 Using the Recompression Chamber	38
	9.4 Decompression Procedures and Tables	39
	9.5 Treatment of Decompression Sickness	42
<hr/>		
▶	10. EMERGENCY	
	10.1 Emergency Procedures	44
	10.2 Accidents and First Aid	45
	10.3 Emergency Calls for Treatment of Decompression Sickness	47
<hr/>		
▶	11. RECORD-KEEPING	
	11.1 Diving Operations Log Book	48
	11.2 Diver's Log Book	48
	11.3 Plant and Equipment Record	49
<hr/>		
▶	12. REFERENCES	50



► Appendices

Appendix I	: RELEVANT PROVISIONS OF THE FACTORIES AND INDUSTRIAL UNDERTAKINGS ORDINANCE (CAP. 59)	54
Appendix II	: ASPECTS WITH RESPECT TO PARTICULAR DIVING MODE A DIVER SHOULD HAVE TRAINING AND EXPERIENCE IN	56
Appendix III	: MEDICAL CERTIFICATE OF FITNESS TO DIVE	58
Appendix IV	: MATTERS IN RESPECT OF WHICH PROVISION IS TO BE MADE IN DIVING RULES	60
Appendix V	: SPECIFICATIONS OF PURITY FOR COMPRESSED AIR	63
Appendix VI	: DIVER DOWN FLAG AND THREE ALL-ROUND LIGHTS	64
Appendix VII	: SPECIFICATIONS FOR SURFACE RECOMPRESSION CHAMBER	65
Appendix VIII	: SPECIFICATIONS FOR DIVING BELL	67
Appendix IX	: MATTERS TO BE ENTERED IN DIVING OPERATIONS LOG BOOK	69
Appendix X	: MATTERS TO BE ENTERED IN DIVER'S LOG BOOK	71



▶ 1. INTRODUCTION

1.1 Purpose

- 1.1.1 This Code of Practice on industrial diving describes the safe diving practice to be adopted in operations in which persons are employed to work underwater. It is intended to be read by diving contractors, diving supervisors and divers, as well as contractors, proprietors and safety personnel of industrial undertakings in which industrial diving operations are involved.
- 1.1.2 This is an approved code issued by the Commissioner for Labour under Section 7A(1) of the Factories and Industrial Undertakings Ordinance (Chapter 59) (hereinafter referred to as 'F&IUO'). It provides a practical guidance to proprietors of industrial undertakings and persons employed at an industrial undertaking who are required to comply with the requirements under Sections 6A and 6B of the F&IUO for the protection of the safety and health of persons at work. It is important to note that compliance with this Code of Practice does not of itself confer immunity from legal obligations in Hong Kong. Besides, statutory provisions referred to or cited in this Code of Practice are those in force as at 1 November 1997.
- 1.1.3 This Code of Practice has a special legal status. Although failure to observe any guideline given in the Code of Practice is not itself an offence, that failure may be taken by a court in criminal proceedings as a relevant factor in determining whether a person has breached the relevant safety and health legislation under the F&IUO or not. It will then be open to that person to satisfy the court that he has complied with the legislation in some other way.



1.2 Scope

- 1.2.1 This Code of Practice covers underwater work using different diving modes including self-contained underwater breathing apparatus (SCUBA) air diving, surface-supplied air diving, and mixed gas or bell diving. It applies to diving operations and related supporting activities conducted in connection with all types of work and employment in industrial undertakings under the interpretation of the F&IUO.



▶ 2. INTERPRETATION

"Bell diving" (鐘式潛水) means the diving mode with diving being carried out using a diving bell.

"Bottom time" (水底時間) means the total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

"Competent person" (合資格人士), in relation to any duty required to be performed under this Code of Practice, means a person who is

- (a) appointed by the diving contractor to perform the duty;
and
- (b) by reason of substantial training and practical experience, competent to perform the duty.

"Decompression sickness" (減壓病) (also known as bends) means the development, upon reduction of pressure during or after diving, of any abnormality in the human body 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 may be involved and its presentation can vary from the acute to the chronic.

"Decompression stop" (減壓停留) means the specific length of time which a diver must spend at a specific depth underwater during ascent 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 to the surface.



"Decompression table" (減壓表) means a profile or set of profiles of depth-time relationship for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

"Diver" (潛水員) means a person employed to work in the water using underwater apparatus which supplies breathing mixture at ambient pressure. In this Code of Practice, reference to diver includes reference to standby diver and extra diver except in clauses where the term diver is used together with standby diver or extra diver.

"Diving bell" (潛水鐘) means an enclosed compartment which allows the diver to be transported to and from the underwater work location and which can be used as a temporary refuge during diving operations.

"Diving contractor" (潛水承判商) means the employer of diving supervisor, diver, or other personnel who provides supporting services for the diving operation.

"Diving location" (潛水位置) means a surface site or vessel from which a diving operation is conducted.

"Diving mode" (潛水模式) means a type of diving requiring specific equipment, procedures and techniques.

"Diving supervisor" (潛水主管) means the competent person appointed in writing by the diving contractor to be in immediate control of the diving operation.

"Diving team" (潛水隊) means a team of personnel comprising divers and supporting personnel involved in a diving operation, including the diving supervisor.



"No-decompression limit" (免減壓極限) means the depth-time limit within which decompression is not required and the diver may ascend directly to the surface.

"Recompression chamber" (加壓室) means a chamber in which persons may be subjected to pressures equivalent to or greater than those experienced while underwater in an actual dive (recompression). The person is first subjected to recompression, followed by decompression according to a decompression schedule for prevention or treatment of decompression sickness.

"Self-contained" (自攜), in relation to any diving plant or equipment, means diving plant and equipment in which the supply of breathing mixture is carried by the diver independent of any other source.

"Standby diver" (後備潛水員) means a diver at the diving location available to assist a diver in the water.

"Surface-oriented diving" (水面為基地的潛水) means a type of diving in which the diver enters the water from the surface and, after completion of the dive, returns to the surface without using a diving bell.

"Surface-supplied" (水面供應), in relation to any diving plant or equipment, means diving plant and equipment in which the breathing mixture is supplied to the diver through a hose from a compressor or storage cylinders at the surface.





3. RESPONSIBILITIES

3.1 General

- 3.1.1 It is a duty of any person, including proprietors and managers of industrial undertakings, who has responsibility for or control over a diving operation to ensure that diving is, so far as is reasonably practicable, safe and is carried out in a safe and healthful manner. A diving contractor should be appointed to be directly responsible for a diving operation.
- 3.1.2 The following summarizes the responsibilities of various parties directly involved in an industrial diving operation, viz diving contractor, diving supervisor and diver who are required to comply with the duty imposed under Sections 6A and 6B of the Factories and Industrial Undertakings Ordinance (Chapter 59). The relevant provisions are listed in Appendix I for reference.

3.2 Responsibilities of Diving Contractor

- 3.2.1 In an industrial diving operation, the diving contractor has the direct responsibility for the safety and health of all persons employed by him.
- 3.2.2 Particular responsibilities of diving contractor include:
- (a) planning and assessment of the diving operation including selection of appropriate diving modes and issuance of Diving Rules (refer to code 6);
 - (b) employing suitable diving supervisors in writing to be in immediate control of the diving operation (refer to code 3.3);



- (c) employing sufficient divers and supporting personnel to form the necessary diving teams for undertaking the diving operation (refer to code 7.1); and ensuring that all team members are over 18 years of age and are medically fit to dive (refer to code 5.1);
- (d) ensuring that the training and experience of all diving team members are commensurate with the required diving mode and the assigned task (refer to code 4.3); and providing training if necessary;
- (e) ensuring that necessary plant and equipment are properly maintained and are available for immediate use and that a plant and equipment register is kept up-to-date containing maintenance records and test and examination certificates (refer to code 8.4);
- (f) providing a Diving Operations Log Book and ensuring that it is properly completed by the diving supervisor (refer to code 11.1);
- (g) providing necessary information, instructions and training to diving team members all aspects related to the diving operation including Diving Rules, use of plant and equipment, safe practices and emergency procedures;
- (h) appointing a medical adviser who is a medical practitioner preferably with special experience in underwater or occupational medicine to provide medical cover and to carry out medical examinations for divers; and where the diving operation involves diving outside the no-decompression limit, or involves other high risk illness or injury, arranging with this medical adviser to be on call;
- (i) ensuring that all diving team members have the appropriate first aid training and experience (refer to code 10.1); and providing first aid equipment on site, including first aid kits and an oxygen unit capable of delivering 100% medical oxygen for a minimum period of time fixed by the medical adviser;
- (j) ensuring that emergency and first aid services are



available including emergency transfer facilities; and that all diving team members are informed of the emergency arrangements (refer to code 10.3);

- (k) ensuring that the diving operation is carried out in a suitable and safe place with the consent of the persons having control of that place; and
- (l) ensuring that effective communication exists between the diving team at the diving location, the persons having control of that place, and the emergency services (including police, ambulance, recompression facility, etc.).

3.3 Responsibilities of Diving Supervisor

3.3.1 The diving supervisor should have immediate control of the diving operation. He should be competent for the task with adequate knowledge of the required diving mode and underwater work, and should have experience as a diver in carrying out the type of work in the assigned operation. He should have the appropriate training and experience in first aid and cardiopulmonary resuscitation, preferably with experience as pure oxygen provider in case of emergency. When supervising diving operations beyond the no-decompression limit, the diving supervisor should be capable of recognizing symptoms of decompression sickness, undertaking routine therapeutic treatment and first aid, and controlling recompression chambers when surface recompression chamber is required on site.

3.3.2 The diving supervisor must at all times be responsible for the safe conduct of the diving operation. He should not dive while acting as diving supervisor and should ensure that:

- (a) the diving operation is carried out in accordance with the Diving Rules issued by the diving contractor and that the operation is under his immediate control (refer to code 6.2);



- (b) the composition and size of the diving team is sufficient for the assigned operation (refer to code 7.1) and that the training and experience of individual team members are commensurate with the assigned tasks (refer to code 4.3);
- (c) every diver is over 18 years of age and has a valid Certificate of Medical Fitness to Dive and is fit to dive at the time the operation starts (refer to code 5);
- (d) plant and equipment comply with all legislative requirements and safe practices;
- (e) appropriate breathing mixture is used and the supply is adequate for the diving operation and any possible emergencies;
- (f) every diving team member has access to the Diving Rules and is fully instructed on the diving plan and understands one's own duties;
- (g) the Diving Operations Log Book is accurately maintained and that he signs the record on a daily basis in respect of each diving operation (refer to code 11.1);
- (h) the daily entries in the Diver's Log Books are correct and that he checks and countersigns those entries regarding the diving operations which are carried out under his supervision (refer to code 11.2); and
- (i) decompression for any diver, where necessary, is carried out properly in the water or in a surface recompression chamber in accordance with the decompression tables stipulated in the Diving Rules (refer to code 9).

3.4 Responsibilities of Diver

- 3.4.1 The diver has a general duty of care for the safety and health of himself and of other diving team members. Before taking part in any diving operation, he should:
- (a) have training and experience in diving and first aid in commensurate with the required diving mode and the diving operation (refer to codes 4.3 and 10.1);



- (b) be over the age of 18 and have a valid Certificate of Medical Fitness to Dive (refer to code 5.1);
- (c) read through the Diving Rules issued by the diving contractor and understand his own duties in the diving operation (refer to code 6.2); and should attend any training or briefing session arranged by the diving contractor if required;
- (d) inform the diving supervisor if he judges himself unfit, or if there are any other reasons why he should not dive or remain underwater or under pressure (refer to code 5.2); and
- (e) prepare and check his breathing apparatus and other equipment for proper functioning before entering water; and should report to the diving supervisor any faults detected in the equipment.

3.4.2 The diver should carry out work in accordance with the instructions of the diving supervisor, and should follow closely the safe practices and any emergency procedures if required, set in the Diving Rules.

3.4.3 The diver should maintain his personal Diver's Log Book, which contains the required specific information, up-to-date (refer to code 11.2). He should sign every entry and ensure that it is countersigned by the diving supervisor.



▶ 4. DIVING MODES AND COMPETENCE OF DIVERS

4.1 Depth Limit of Air Diving

- 4.1.1 Compressed air should not be used as breathing mixture for diving at depths exceeding 50 metres (165 feet), principally because divers at such depth may suffer from narcotic effects of nitrogen.
- 4.1.2 For diving at depths exceeding 50 metres (165 feet), it is necessary to replace compressed air with a suitable breathing mixture in which the proportion of nitrogen is reduced or eliminated. A mixed-gas which is a mixture of oxygen and helium is generally used for breathing. Suitable mixtures of oxygen, helium and nitrogen are sometimes used with an aim to reducing certain physiological problem and heat loss.

4.2 Diving Modes

- 4.2.1 Diving modes can be categorized according to the breathing apparatus used:
- (a) **SCUBA air diving:** air diving using self-contained underwater breathing apparatus for carrying out work for which no surface recompression chamber is required on site (refer to code 9.2 on provision of recompression chamber);
 - (b) **Surface-supplied air diving:** air diving using surface-supplied equipment for carrying out work not exceeding 50 metres in depth; and
 - (c) **Mixed-gas or Bell diving:** diving for carrying out work at depths normally exceeding 50 metres in which a mixed-



gas is used for breathing or saturation diving technique may be employed.

- 4.2.2 Both SCUBA and surface-supplied air diving can be regarded as surface-oriented diving in which the diver enters the water from the surface, proceeds to the depth at which the work is carried out, carries out the work and returns to the surface with either decompression stops in the water or decompression in a surface recompression chamber. Sometimes surface-oriented diving is carried out in a simple diving bell, known as "wet bell" which acts as a lift to carry the diver to the work site and back to the surface.
- 4.2.3 SCUBA diving using the open-circuit principle has an inherent limitation for sustained hard work at any depth. The likely breathing gas consumption for the operation should be appropriately assessed, which varies greatly depending on the physique of the diver, the nature of the underwater work and the environment. For diving at greater depths, it becomes increasingly difficult to make reliable assessment of gas consumption under varying conditions. As a result, SCUBA diving is only recommended for limited-duration observation work not involving extended programmes. Surface-supplied diving does not require the same extent of breathing gas consumption assessment, and therefore should be used under all other circumstances, especially in construction work and in the use of cranes or surface operated equipment which can increase the possibility of diver entrapment and the associated danger of increased air consumption through exertion of energy or extended underwater period.
- 4.2.4 For diving exceeding 50 metres in depth, bell diving should be used in which the diver is transported in a diving bell from the surface to the work site underwater and then returned to the surface in the bell and subsequently to a surface recompression chamber for decompression.



4.3 Competence of Divers

- 4.3.1 Basically, any diver (including standby diver and extra diver) or other diving team member who is competent to take part in an industrial diving operation should have the training and experience necessary to perform the assigned task in a safe manner. The training and experience in general terms should include:
- (a) technique of the required diving mode;
 - (b) the assigned underwater work;
 - (c) the use of tools, equipment and system relevant to the assigned task; and
 - (d) safe practices and emergency procedures.
- 4.3.2 Regarding competence to dive in a particular diving mode, a diver should have training and experience in various aspects of the respective mode, specified in Appendix II. Documentary proof of competence can be a certificate, obtained by training or assessment of experience up to international standard, recognized by an organization or government agency in diving or related disciplines (e.g. the National Association of Underwater Instructors of USA; Health and Safety Executive of UK; Department of Employment, Vocational Education, Training and Industrial Relations of Australia; Ministry of Communication of People's Republic of China; or equivalent).





5. MEDICAL FITNESS OF DIVER

5.1 Certificate of Medical Fitness to Dive

5.1.1 In general any person, who is likely to be subjected to pressure greater than atmosphere, must be medically fit. A diver must be medically examined and should be in possession of a Certificate of Medical Fitness to Dive. A valid Certificate of Medical Fitness to Dive should be issued by a medical practitioner preferably with special experience in underwater or occupational medicine, not more than 12 months before the date of the diving operation. The certificate should contain the details specified in Appendix III and should be entered into the Diver's Log Book. A new certificate of fitness should be obtained if the diver has been sick for a continuous period of 14 days or more.

5.2 Physical Fitness of Diver

5.2.1 It is very important that a diver should be physically and psychologically fit before commencing a diving operation. Diving should not be undertaken if the person is suffering from any illness. Common cold and any other respiratory tract infections are temporary disqualifying conditions for diving. To avoid emergencies caused by medical conditions and the development of long term health problems, a diver should be medically examined for fitness before employment for underwater work. He should be examined even before he commences training and at regular intervals of not exceeding 12 months during his career.



- 5.2.2 A person is considered unfit to dive if he has any medical condition which
- (a) may impair his safety or safety of other diving team members while diving;
 - (b) may be significantly aggravated by diving; or
 - (c) may significantly increase the likelihood of developing long term health problems associated with diving.





6. PLANNING AND DIVING RULES

All diving operations require planning and foresight. The diver must be placed in the job under optimum conditions of knowledge, equipment, ability, safety and freedom from distractions. The diving contractor is responsible for the planning of the diving operation and assessment of all possible risks that may be involved in ensuring the safety and health of all diving team members, and the issuance of the Diving Rules.

6.1 Planning and Assessment

- 6.1.1 In planning a diving operation, prime consideration should be given to the type of underwater work and the conditions of the site in which the work is carried out. The diving contractor should obtain appropriate information about the work and the work site including the maximum depth and depth at the greatest tide during the work period, the underwater conditions and environment, and the water temperature.
- 6.1.2 The diving contractor should determine which diving mode is most appropriate for the diving operation taking into consideration the type of work to be done by the diver, the equipment required, the conditions under which the diver will work and the inherent risks and limitations of different breathing apparatus (refer to code 4.2).
- 6.1.3 Such factors as the nature of the work, the required diving mode and the time spent underwater should be considered in deciding on the composition of diving team or teams, breathing gas and other supplies, supporting services, and decompression procedures and facilities.



- 6.1.4 Careful consideration should also 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, presence of ship or other craft movement in the vicinity and any other hazards that may affect the operation such as shark attack.

6.2 Diving Rules

- 6.2.1 Diving Rules are detailed instructions issued by the diving contractor to the diving supervisor and other diving team members in relation to the general conduct of the diving operation in a safe and healthful manner. The diving supervisor should ensure that every diving team member has ready access to relevant parts of the Diving Rules and understands one's own duties, safe practices, and emergency procedures and arrangements.
- 6.2.2 Diving Rules should cover planning, preparation, procedures during diving, safe practices and emergency procedures. A guide to the detailed content of Diving Rules is listed in Appendix IV. The content should include the general principle of the diving techniques and the requirements of specific operations. Diving contractors may, if they wish, prepare a standard set of Diving Rules and supplement the standard set by more specific instructions pertaining to particular situations.



7. DIVING SUPPORT

7.1 Diving Team

7.1.1 Competent diving teams of sufficient personnel should be set up to undertake the diving operation safely, and to operate plant, equipment and other facilities that are necessary for the safe conduct of the operation. The implementation of the necessary supporting services will depend on the scope of the operation and should be covered by the Diving Rules issued under code 6.2.

7.1.2 A team of at least 3 persons should be present for each diving operation when the dive does not exceed 30 metres (100 feet) in depth and the dive remains within the no-decompression limit. The diving team should comprise:

- (a) the diving supervisor;
- (b) the diver engaging in the underwater work; and
- (c) a standby diver at the diving location (equipped and ready to dive).

Other appropriate personnel are required to operate plant and equipment, and to provide supporting services during the diving operation.

7.1.3 In the following cases, some variations may be allowed to code 7.1.2:

- (a) For shallower diving operations not exceeding 1.5 metres (4.5 feet) in depth and clear of currents, it may only be necessary for the diver to be supported by a diving supervisor;



(b) For SCUBA air diving within the no-decompression limit where two divers, normally connected together with a signalling line and with one of them connected by a lifeline to the surface, are working in close proximity and able to provide immediate assistance to one another in an emergency, one of the divers may be the standby diver for the other diver in the water provided there is clear communication between them and with the surface.

7.1.4 An extra diver at the diving location (in addition to the standby diver) should be present in the following cases:

- (a) air diving with decompression stops;
- (b) air diving exceeding 30 metres (100 feet) in depth;
- (c) air diving where there is a special hazard.

7.1.5 Examples of special hazard refer to in code 7.1.4(c) include dives associated with:

- (a) enclosed or physically confined spaces (the extra diver should be stationed at the underwater point of entry);
- (b) particularly poor underwater visibility that may lead to trapping hazards;
- (c) work close to weirs, sluices, locks;
- (d) the use of lifting appliances for lowering equipment or materials into water;
- (e) the use of heavy tools that could affect a diver's balance or buoyancy.

7.1.6 For bell diving operations, the diving team should have at least five members. During the operation, at least two divers must travel to the underwater work site in the diving bell, one of whom acts as the standby diver in the bell while the other undertakes the work outside the bell. Further, there should be a diving supervisor and at least one other standby diver at the diving location (equipped and ready to give support if the divers in the bell need assistance once the bell is recovered to the air



diving range), and such other personnel as appropriate to operate the necessary plant, equipment and other facilities.

7.2 Breathing Apparatus and Gas Supply

7.2.1 Appropriate breathing mixture should be supplied to the divers by suitable means of correct formulation and temperature at ambient pressure, and at a suitable and adequate flow-rate in order to sustain prolonged, vigorous physical work of the divers during the diving operation. The breathing apparatus should include appropriate means of providing reserve supply of breathing mixture for divers' immediate use in case of emergency and additional supplies for decompression purposes.

7.2.2 A reserve supply of breathing mixture should be provided for all types of diving. For SCUBA diving, emergency reserve supply of breathing mixture in a separate bottle should be an integral part of the equipment carried by the diver. For surface-supplied diving, each diver should carry a "bail out bottle" of breathing mixture, which can be quickly switched into the breathing circuit in case of emergency.

7.2.3 Breathing mixture can be supplied by an air compressor or from gas cylinders. When planning supplies of breathing mixture, both for use in the operation and for reserves, allowance should be made for the time it takes for the standby diver to reach the diver in distress and for both of them to return safely from the maximum depth of the dive to the surface.

7.3 Air Supply from Compressor

7.3.1 When breathing air is supplied to the diver from an air compressor, the diving contractor should ensure that suitable equipment is used to supply adequate breathing air for the



diving operation and the purity of the air is in compliance with the specifications listed in Appendix V.

- 7.3.2 Adequate precautions should be taken to avoid contamination of air supply and the following precautions should be included:
- (a) The equipment should be maintained according to manufacturer's instructions.
 - (b) The air intake of the compressor should be properly located to avoid sucking in contaminated air such as engine exhaust.
 - (c) Compressor designed for other industrial purposes should not be used to supply air for diving, as the filter efficiency is inadequate. Previously used hose which may be oil impregnated or otherwise contaminated should not be used.

7.4 Cylinder Gas

- 7.4.1 All cylinders containing breathing mixtures for diving purposes should be correctly labelled and coloured. Gas cylinders should be painted with the appropriate colour or colours and stencilled at the valve end with chemical name and percentage of each component of the mixture, with the percentage of oxygen shown first. Appropriate hazard symbol, risk and safety phrases should also be included in the label.
- 7.4.2 It is important to make sure that the correct breathing mixture is used for a particular diving mode. The label of the cylinder should be checked for correct constituents and proportions of the gases when the gas cylinder is delivered to site, immediately prior to use and during the period when the breathing mixture is put "on line".
- 7.4.3 If charging of the SCUBA gas cylinder has been performed more than 6 hours before a dive, the cylinders should be



checked for correct pressure immediately prior to the dive. The diving supervisor should ensure that the diver carries out final checks on his breathing apparatus and other personal equipment before entering the water and should continuously monitor the diver's conditions by means of an established mode of communication during the course of the dive.

7.5 Lifeline

- 7.5.1 Properly secured and tended lifeline for each diver should be provided for all diving operations, except where restriction on mobility due to the lifeline would itself create a hazard. Lifeline may be a rope, communication cable, or any combination of these. It must be adequate in strength and suitable for recovering the diver under normal operation and emergency conditions without dislodging life-support equipment. In an emergency, the lifeline may be used to lift a diver and his equipment clear of the water by hand.
- 7.5.2 If a diving operation is found to be particularly difficult or hazardous due to the use of fixed lifelines, other appropriate systems should be considered. For dives not exceeding 30 metres in depth, a system of marked diving using a floatline which is connected to a float and monitored from an appropriately manned support craft on the surface may be used.
- 7.5.3 Where two divers are working together underwater at a depth not exceeding 30 metres and when they can communicate clearly with each other through a signalling line, only one of them is required to be connected and tended by a lifeline to the surface or connected by a floatline if this is in the interest of safety to do so.



- 7.5.4 A lifeline should not be less than 8 mm in diameter for ease of handling. A lifeline of adequate strength for rescue purposes, having regard to the weight of the diver, may be less than 8 mm in diameter for connecting a diver to a float to permit the use of a compact reel, or to reduce underwater drag. However additional emergency arrangements may then be necessary for lifting the diver out of water quickly after raising him to the surface.

7.6 Communication

- 7.6.1 Effective communication between all diving team members is a very key factor for the safe conduct of a diving operation. For a diving operation, the established means of communication should be included in the Diving Rules and made known to all team members. Communication can be done by using a lifeline with an established signalling system or by using a reliable audio system. For diving operations involving machinery such as cranes, an efficient means of voice communication between the machine operator and the diving supervisor, and in turn with the diver should be used.
- 7.6.2 Audio communication is always preferred. However, for diving operation not exceeding 30 metres (100 feet) in depth, communication through the tended lifeline is a minimum acceptable means of communication between a diver and his team members on the surface.
- 7.6.3 All divers working underwater should be able to communicate directly with team members on the surface unless code 7.5.3 applies where only one of the divers is required to be able to communicate with the surface through the tended lifeline.
- 7.6.4 For bell diving, there should maintain a means of audio communication between the diver in the diving bell and the



diving supervisor, and between the diver working underwater outside the bell and the supervisor.

- 7.6.5 Audio communication should preferably be through a hardwire integral with the lifeline and gas hose, if applicable, and should provide appropriate means for the diving supervisor to monitor the diver's breathing pattern at all times. When the breathing mixture contains helium or other gases that may distort sound transmission, a suitable voice processor should be fitted into the circuit. Alternative signalling arrangements should be provided as a backup for the hardwire system. For bell diving, a through-water communication system should be used. With surface-oriented diving, the surface or float line can be used as the primary or secondary means of communication if the safety of divers can reasonably be assured in the absence of a hardwire system.





8. GENERAL SAFE PRACTICES

The following safe practices are relevant for different stages of a diving operation in general and for dealing with particular aspects or situations. It should be noted that these are safe practices in general. Additional practices necessary for specific underwater work involved should be considered and adopted. Reference should also be made to other parts of this Code of Practice covering specific aspects.

8.1 Pre-dive Practices

- 8.1.1 Planning and assessment of the diving operation should be conducted, and Diving Rules should then be issued.
- 8.1.2 All plant and equipment and other supporting services specified in the Diving Rules should be provided and arrangements should be made to ensure that safety precautions are taken and working procedures are followed.
- 8.1.3 Diving team or teams with sufficient number of competent persons for the assigned diving operation should be set up. Members of the diving team should include personnel to operate plant and equipment and to provide supporting services.
- 8.1.4 Copies of Diving Rules and decompression tables, if appropriate should be available for reference at the diving location.



- 8.1.5 All diving team members should be informed of:
- (a) the required diving mode and the underwater work to be undertaken;
 - (b) any unusual hazards or environmental conditions likely to affect the safety of the divers and the appropriate precautions; and
 - (c) safe practices and emergency procedures including emergency ascent.
- 8.1.6 All plant, equipment and supplies should be checked by competent persons within 6 hours immediately before the diving operation commences.
- 8.1.7 Emergency services should be arranged and effective communication between the diving location and the emergency services should be maintained.
- 8.1.8 The 'diver down flag' or for diving operations at night, three all-round lights (Appendix VI) in accordance with the Convention on the International Regulations for Preventing Collisions at Sea, 1972 should be displayed at the diving location.

8.2 During-dive Practices

- 8.2.1 Adequate arrangements should be made and maintained to ensure that divers can enter and leave the water safely at all times. These arrangements should take full account of the difficulties that may occur at the air/water interface, particularly if such place is easily affected by weather conditions.
- 8.2.2 A team member on the surface should be responsible to monitor boat traffic and situations that may be potential hazards such as sudden change of weather and shark attack, especially when divers are entering, descending, ascending or exiting the water.



- 8.2.3 An appropriate lifeline should be used by each diver unless it is unsuitable in the circumstances, in which case alternative measures should be adopted to ensure the safety of the diver.
- 8.2.4 Effective means of communication should be established and maintained between the divers and the diving supervisor throughout the diving operation.
- 8.2.5 In any underwater work, safe systems of work should be established to suit its specific situations. All tools and equipment involved should only be handled and used by competent persons. The Diving Rules should be strictly adhered to, in particular those relating to specific hazards associated with that underwater work and the required tools and equipment. Examples of specific hazards include electric shock, striking by loosen object or machine parts, lifeline or gas hose being entangled by machine parts, fire and explosion, leakage of toxic gases, etc.
- 8.2.6 Under the following emergency situations, diving operation should be terminated:
- (a) There is a sudden change in environmental conditions such as weather rendering the diving operation hazardous.
 - (b) The diver requests termination.
 - (c) The diver fails to respond correctly to signals from a diving team member.
 - (d) Communications are lost and cannot be re-established between the diver and the diving team at the diving location.
 - (e) Diver begins to use the reserve breathing gas supply.

8.3 Post-dive Practices

- 8.3.1 After the dive, the physical condition of the diver should be examined, and the diver should report any physical problems



or adverse physiological effects (including symptoms of decompression sickness) to the diving supervisor.

- 8.3.2 Every diver should update his Diver's Log Book which is subsequently countersigned by the diving supervisor. The diving supervisor should update the Diving Operations Log Book.
- 8.3.3 Where decompression is required, either being carried out in the water or in a surface recompression chamber, it should be carried out properly according to the decompression tables adopted in the Diving Rules. It must be emphasized that the system and procedures set out in these tables and any other instruction laid down by the diving contractor should be followed and adhered to.
- 8.3.4 After a diving operation beyond the no-decompression limit divers should wear, for at least 24 hours after completion of the dive, personal labels or cards indicating they are divers, and the location and contact telephone number of the surface recompression chamber for therapeutic treatment where they should be conveyed if taken ill.
- 8.3.5 Diver should not take a flight within 12 hours after surfacing from a no-decompression dive, and this period should be extended to 24 hours when decompression is required after the dive.

8.4 Equipment Examination and Testing

- 8.4.1 All plant and equipment should be periodically examined and tested by competent persons in accordance with manufacturer's instructions and recommendations. These tests, depending on the type of plant or equipment, may include pressure test, pressure leak test, hydraulic pressure test,



functional test, load test, etc. For each examination and test, a signed certificate should be obtained and kept in the plant and equipment register which is maintained by the diving contractor.

- 8.4.2 To ensure the safe use of the plant and equipment, all of them should undergo functional check by competent persons within 6 hours immediately prior to the commencement of the diving operation.

8.5 Protection from Cold

- 8.5.1 The need for heating to maintain a diver's body temperature depends on water temperatures as well as depth and breathing mixtures. For diving operation exceeding 50 metres (165 feet) in depth, there should be a means of heating the diver while diving. At depths exceeding 150 metres (495 feet), a means to heat up diver's breathing mixture is also required.
- 8.5.2 For surface-oriented diving operations, divers do not usually need heating of the diving suit because the diving duration is relatively short and heat loss when breathing air is considerably less than with oxygen-helium mixtures. Thermal protection is normally provided by means of wet or dry suit but, when diving in cold water and for relatively long duration towards the deeper end of the diving range, consideration should be given to equipping divers with water-heated suit.

8.6 Diving in Culverts, in Locks, on or near Outfalls and in Pipelines

- 8.6.1 Diving operations are especially hazardous in areas where there may be sudden discharges, sudden flow of hot water or chemicals, unexpected or very fast currents or differential pressures. Examples include work in culverts, docks, locks,



tunnels and on or near weirs, outfalls and pipelines. Apparently calm surface water may hide strong undercurrents, and sudden flow of water may be caused by the opening of gates, sluices or valves, flash floods, change of tide and the starting up of ships' engines.

8.6.2 Before commencing diving operation in these circumstances, the diving contractor and the diving supervisor should ensure that the following basic precautions are taken whenever applicable:

- (a) Ascertain the position of any culvert, lock, tunnel, weir, outfalls, pipe-end, etc., where sudden flow of water may occur endangering the lives of the divers in the water. Check whether a diver could be recovered from downstream of any incident caused by a sudden flow of water or upstream if he is sucked into a pipe or tunnel grating;
- (b) Ensure that the owners of any such installation (and of dock and pipeline) are fully informed of the nature, extent and time of any planned diving operation; that their local representatives (including site agents and client's representatives) are informed; that they in turn have given instructions regarding the operation (or non-operation) of valves, gates, etc., to their employees or agents at or near the site; and that a permit-to-work system has been established;
- (c) Before any valve, gate or other plant resumes operation, all divers should be removed from the water. To prevent accidental operation of valves etc., these should be secured and the means of operation is under the control of the diving supervisor so far as is reasonably practicable.



▶ 9. DECOMPRESSION

9.1 Methods of Decompression

- 9.1.1 Decompression is a controlled procedure by which the high pressure experienced by the diver due to the depth in the water is lowered to atmospheric pressure on the surface. After diving beyond the no-decompression limit, decompression must be carried out so that the additional gas dissolved in the diver's body during the diving period resulted from the high water pressure at the depth of the dive can leave the body tissue without giving rise to decompression sickness.
- 9.1.2 Decompression can be carried out in the water, or on the surface in a recompression chamber, or in a diving bell or in any combination of them. Surface recompression chamber and diving bell should comply with the specifications in Appendices VII and VIII respectively.

9.2 Provision of Recompression Chamber

- 9.2.1 For in-shore diving operations, the minimum requirement for provision of surface recompression chamber are laid down as follows:



Operating Depth	Recompression Chamber Requirements
within 10 metres (33 feet)	No recompression chamber is required on site, provided suitable and rapid transport to the nearest recompression chamber for treatment is available.
10 to 50 metres (33 to 165 feet)	For dives within no-decompression limit or with total decompression time not exceeding 20 minutes, no recompression chamber is required on site, provided that it is made available suitable and rapid transport to a 2-compartment surface recompression chamber within 2 hours from the time when the need for recompression therapy is identified.
	For dives with total decompression time exceeding 20 minutes, 2-compartment recompression chamber is required on site, but if only single compartment chamber is available on site, then facilities are required for transferring the chamber under pressure to a 2-compartment chamber within 4 hours.
over 50 metres (165 feet)	2-compartment surface recompression chamber is required on site.

9.3 Using the Recompression Chamber

9.3.1 Recompression chamber must be operated by competent persons. Before using a recompression chamber the operator should check that:

- (a) the chamber is clean internally and free from combustible material;
- (b) air and oxygen cylinders are fully charged, and that for air from compressors the air is at the required pressure and adequately filtered;



- (c) where applicable, sufficient oxygen breathing apparatus is available and connected to the chamber supply points, and that this apparatus has been tested;
- (d) chamber doors are operating properly and that any associated air-lock door is securely closed;
- (e) lighting and communication systems are functioning properly;
- (f) exhaust outlets are clear;
- (g) safety valves set at correct override pressure are fitted and in-date for test; and
- (h) time-keeping and recording equipment is fitted and functioning.

9.3.2 Any diver who is undergoing recompression or decompression schedule in a chamber should always be supervised by a competent person.

9.3.3 When no life support system is used, the chamber should be flushed through periodically to avoid accumulation of carbon dioxide.

9.3.4 Every precaution should be taken to prevent fire. Combustible material and any means of ignition should not be allowed in the chamber. Smoking and any other open flame in the chamber is strictly prohibited.

9.4 Decompression Procedures and Tables

9.4.1 In planning a diving operation, the diving contractor should select and adopt suitable decompression tables for decompression purposes, which should be included in the Diving Rules. The decompression tables should also be available at the diving location and accessible to all diving team members. Recognized decompression tables can be:

- (a) Royal Navy (RN) Tables;



- (b) United States Navy (USN) Tables;
- (c) Australian Royal Navy (ARN) Tables;
- (d) Defence and Civil Institute of Environmental Medicine (DCIEM) Tables;
- (e) National Oceanic and Atmospheric Administration (NOAA) Tables;
- (f) Comex Tables; or any equivalent tables.

9.4.2 It must be noted that any set of decompression tables developed for use by different institutions is based on the best available experimental and operational data, and certain level of personal physiology, training and maintenance is presumed. The tables should be used with caution taking into consideration all possible variations in the above aspects. Users of the tables should be aware that decompression according to recognized tables does not eliminate all risk of decompression sickness, and conservative diving practices should be followed wherever possible.

9.4.3 Decompression should be carried out according to the adopted decompression tables. The decompression schedule set out in the tables must be strictly adhered to, unless the diver is injured or ill and the diving supervisor considers treatment for the injury or illness is more important than the risk of decompression sickness. The name or designation of the decompression tables used should be recorded in the Diver's Log Book and countersigned by the diving supervisor. Any incident of decompression sickness should be recorded in the Diving Operations Log Book.

9.4.4 In diving operation where hard physical work is carried out by the diver, or where the water temperature is low, the diver's body tends to absorb more gas than other diving operations. A longer period of decompression to eliminate the absorbed gas will be required. The decompression routine for the dive



should follow the schedule for the next longer time increment for the dive, or the next greater depth listed in the tables being used, or both. It is the responsibility of the diving contractor to assess how decompression should be adjusted in the planning stage, and the adjustments made to the decompression schedule should be written in the Diving Rules and be given to all diving team members.

- 9.4.5 During surface-oriented diving operations, when decompression is carried out in the water the diver, apart from being supported by his lifeline, should always be on a shot rope with markings indicating the diver's depth. In order to carry out decompression safely, the maximum depth of dive and the depth at each decompression stop must be known accurately. This can generally be achieved with the shot rope vertical in the water. If vertical position cannot be maintained, the shot rope may be lifted off the bottom to hang as a lazy shot. Decompression stops must be carried out with the diver at rest.
- 9.4.6 As an alternative method to carrying out decompression in the water for air diving, the technique of surface decompression may be used when the following conditions are satisfied:
- (a) A recompression chamber must be available with a working pressure equivalent to at least the maximum depth of the dive.
 - (b) The diver must be able to leave the last underwater stop, return to the surface, enter the chamber and be recompressed without hindrance, all within a period specified in the decompression tables being used.
 - (c) Sufficient number of competent persons must be available to assist the diver out of the water and into the surface recompression chamber, and to control the chamber according to the decompression schedule set out in the Diving Rules.



9.5 Treatment of Decompression Sickness

- 9.5.1 Any diver showing signs or symptoms that cannot be attributed to any other cause must be treated for decompression sickness. Unless the treatment is taken care of by a medical specialist, the diving supervisor is responsible for carrying out first aid and treatment work, and where necessary should consult the diving contractor's medical adviser.
- 9.5.2 The majority of cases of decompression sickness occur within the hour or two following a dive. If decompression has been shortened or bypassed, the diver may suffer from decompression sickness before he reaches the surface. Occasionally however, decompression sickness may become apparent many hours or even days after a dive. Symptoms that occur after 24 hours (although less likely to be due to decompression sickness) should be referred for medical advice. If there is any doubt about making the diagnosis it should be assumed that the diver is suffering from decompression sickness and should be treated accordingly.
- 9.5.3 When carrying out first aid:
- lay the patient flat;
 - administer 100% medical oxygen immediately by competent persons;
 - administer fluids orally if patient's airway is clear (patient can talk).
- 9.5.4 If a diver is suffering from decompression sickness, he should be recompressed according to the therapeutic table set out in the Diving Rules. Guidelines for treating decompression sickness are listed in the following:
- (a) Treat promptly, even if there is doubt as to the diagnosis. Seemingly minor symptoms should not be ignored. Minor symptoms may quickly develop to major ones.



- (b) Do not delay treatment while waiting for medical advice. The effectiveness of treatment decreases the longer the treatment is delayed.
- (c) Follow the procedure for treatment set out in the Diving Rules accurately and completely.
- (d) Do not assume that the treatment is no longer necessary when a symptom or a group of symptoms seems to be relieved. It is imperative to follow the therapeutic tables to the end, and to keep the diver in the immediate vicinity of the chamber under supervision for the full period set out in the Diving Rules. The diver should not be allowed to sleep as this would mask loss of consciousness or paralysis.

9.5.5 The most common errors in the treatment of decompression sickness are:

- failure of the diver to report symptoms;
- failure to treat doubtful cases;
- delay in starting recompression therapy;
- failure to treat serious cases adequately;
- failure to keep the diver under adequate supervision following the initial therapy.

Symptoms may occasionally become worse during the initial stage of therapeutic recompression. If this occurs, the recompression should be stopped momentarily and then resumed slowly at a rate the diver can tolerate.



▶ 10. EMERGENCY

10.1 Emergency Procedures

- 10.1.1 Accidents and emergencies require a quick response if they are to be prevented from becoming more serious. Before diving operation starts, the diving contractor should made detailed planning and assessment for possible emergencies at all depths and locations and the availability of emergency services. He should also ensure that there are effective means of communication between the diving location, the people who has control of the location and the emergency services.
- 10.1.2 If a diving operation is being carried out without a recompression chamber on site, the diving contractor has a specific responsibility to locate the nearest chamber prior to the operation, and to make arrangements to use the chamber in the event of an emergency.
- 10.1.3 General emergency procedures and any procedures specific to the operation as well as information on the arrangements for emergency services should be provided in the Diving Rules which should be accessible to all diving team members.
- 10.1.4 In addition to the general safety requirements concerned with the prevention of injury or illness to divers, it must always be borne in mind that :
- (a) a diver should not go, and must never remain underwater if he does not feel well;
 - (b) any loss of consciousness underwater may prove fatal;
 - (c) any illness occurring during or after a dive must be assumed to be due to the dive until it is proved otherwise;
- and



(d) taking drugs or alcohol prior to dive is prohibited.

10.1.5 All divers should have training and experience in first aid and basic underwater medicine so that, in a medical emergency, all diving team members have sufficient knowledge to proceed with appropriate treatment or corrective action in consultation with the diving supervisor. A diver should possess a valid certificate in first aid, including cardiopulmonary resuscitation, issued by organizations such as the Hong Kong Red Cross, St. John Ambulance Association, Auxiliary Medical Services, or equivalent organisations. For diving operations beyond the no-decompression limit or in remote locations where the assistance of a medical practitioner cannot be obtained quickly, at least one member of the diving team should have further training and experience in diving rescue and first aid, and be able to go underwater to perform rescue operation without compromising the team (i.e. not the supervisor).

10.1.6 Medical instructions and equipment should be provided at the diving location to enable all diving team members to carry out first aid or to save life in an acute situation. All accidents and incidents requiring first aid or medical intervention should be accurately recorded in the Diving Operations Log Book.

10.2 Accidents and First Aid

10.2.1 A seriously injured or ill diver should be subjected to a brief structured examination before treatment is started and any findings should be reported to the diving supervisor. The following examination and immediate action should be included, as appropriate :

- (a) Is the patient breathing? If not:
- clear airway of vomit, blood, broken teeth, etc.
 - start artificial ventilation.



- (b) Is the heart beating? Feel for the pulse at neck and wrist.
If not:
- start external chest compression.
[It should be aware that a delay of only a few minutes in the actions described in (a) and (b) above may result in brain damage or death.]
- (c) Is the patient bleeding?
- stop any serious bleeding with direct pressure.
 - immobilize obvious broken limbs to minimize further damage.
- (d) Is the patient in shock?
- (e) Does the patient complain of lightheadedness?
- (f) Is the patient pale, sweating or cold?
- (g) Does the patient have a fast, weak pulse?
- (h) Is the patient unconscious?
- (i) Does the patient answer questions?

10.2.2 If there are signs or symptoms that the central nervous system is affected, the diver should be recompressed immediately.

- (a) Detailed examination to be carried out in the chamber includes:
- (i) what the problems is;
 - (ii) a brief history including:
 - when the problem started;
 - the first signs and symptoms;
 - (iii) the present signs and symptoms, including:
 - state of breathing (including rate);
 - presence of cough and any association with pain, blood or phlegm;
 - state of heart beat (including rate);
 - any haemorrhage;
 - any shock;
 - state of consciousness.
- (b) If external chest compression and/or artificial ventilation has to be started, the procedure should be continued until



a medical practitioner takes over. If the diver recovers, he should be sent for medical evaluation immediately.

- (c) It should be aware that underlying obvious signs such as bleeding could be a symptom of decompression sickness, for which immediate treatment is essential.
- (d) NEVER ASSUME THAT THE PATIENT IS DEAD.

10.2.3 It should be noted that decompression sickness is a notifiable disease under the Factories and Industrial Undertakings (Notification of Occupational Diseases) Regulations (Chapter 59). Any case involving decompression sickness resulted from an industrial diving operation should be referred to the Director of Health.

10.3 Emergency Calls for Treatment of Decompression Sickness

In case of emergency, the Fire Services Department may be summoned for assistance for arranging the patient to be sent to the Recompression Treatment Centre located at Ngong Shuen Chau for therapeutic treatment of decompression sickness. Emergency calls can be made to the Hong Kong Police Force (Tel: 999) or to the Communication Centre of the Fire Services Department (Tel: 2723 2233).



▶ 11. RECORD-KEEPING

11.1 Diving Operations Log Book

11.1.1 Diving contractor should provide a Diving Operations Log Book and the diving supervisor has a specific responsibility to complete it on a daily basis and to sign all entries during the course of the diving operation under his control.

11.1.2 Diving Operations Log Book should contain information as detailed in Appendix IX. All incidents affecting the safety of any diving team member should be clearly recorded.

11.1.3 Diving Operations Log Book should be maintained for all diving operations in the water, as well as for simulated diving in surface recompression chamber for which equivalent records need to be kept.

11.1.4 Diving Operations Log Book should be retained for at least two years after the date of the last entry in it.

11.2 Diver's Log Book

11.2.1 Each diver should maintain a personal Diver's Log Book containing his photograph, Certificate of Medical Fitness to Dive and details of the diving activity as set out in Appendix X. A Diver's Log Book should also be maintained by anyone who is exposed to pressure for the purpose of diving operations, including those who may be involved in simulated diving in surface recompression chamber. The Certificate of Medical Fitness to Dive should be an integral part of the Diver's Log Book, be up-to-date and is issued by a medical practitioner



preferably with special experience in underwater or occupational medicine. The Diver's Log Book should be presented to the medical practitioner at medical examinations for reference.

- 11.2.2 It is the responsibility of the diver to maintain his personal Diver's Log Book up-to-date, to keep it safe and to ensure that it contains the necessary certificates. The day-to-day diving record maintained in the Diver's Log Book should be countersigned by the diving supervisor responsible for the day's diving operation.
- 11.2.3 Each diver should keep his personal Diver's Log Book for a period of at least two years from the day of last entry in it. One should not be allowed to work as a diver without the Diver's Log Book.

11.3 Plant and Equipment Record

- 11.3.1 As mentioned in code 8.4, a diving contractor is responsible to maintain a plant and equipment register. For each item of plant and equipment, the register should contain up-to-date reports and certificates of examination, testing and maintenance. The record should be kept for at least two years from the date of the last certificate it contains.





12. REFERENCES

For further information on special aspects of various diving modes and associated work activities, the following references may be useful:

- (a) *The Royal Navy Diving Manual (BR2806)*, HMSO, London
- (b) *US Navy Diving Manual*, Navy Department, Washington D.C.
- (c) *The Principles of Safe Diving Practice*, CIRIA Underwater Engineering Group, London
- (d) *British Standard*, British Standards Institute, London
BS4001 Recommendation for the Care and Maintenance of Underwater Breathing Apparatus
Part 1: 1981 Compressed air open circuit type
Part 2: 1982 Standard diving equipment
BS 4667: 1974 Breathing Apparatus
Part I: Closed-circuit breathing apparatus
Part II: Open-circuit breathing apparatus
Part III: Fresh air hose and compressed air line breathing apparatus
- (e) *The Medical Examination of Divers*, MAI information and advice from the Health and Safety Executive, UK (1987)
- (f) *The British Sub Aqua Club Diving Manual*, London
- (g) *Rules and Regulations for the Construction and Classification of Submersibles and Diving System*, Lloyds Register of Shipping, London
- (h) *Rules for Building and Classing Underwater System and Vehicles*, American Bureau of Shipping, New York
- (i) *Safety and Operational Guidelines for Undersea Vehicles*, Marine Technology Society, Washington D.C.
- (j) P.B. Bennett, D.H. Elliott, *The Physiology and Medicine of Diving and Compressed Air*, Bailliere, Tindal, London



- (k) W. Penzias, et al, *Man Beneath the Sea*, Wiley Inter-Science, New York
- (l) S. Miles, *Underwater Medicine*, Staples Press, London
- (m) T.C. Schmidt, V.A. Door, R.W. Hamilton, *Chamber Fire Safety*, Ocean Systems Inc., Technical Memorandum UCR1-721
- (n) *Safety and Health in Building and Civil Engineering Work*, International Labour Organization, Geneva
- (o) J.E. Kenny, *Business of Diving*, Gulf Publishing Company, Houston





APPENDICES

**Occupational Safety and Health Branch
Labour Department
January 1998**

Appendix I

RELEVANT PROVISIONS OF THE FACTORIES AND INDUSTRIAL UNDERTAKINGS ORDINANCE (CAP. 59)

General Duties of a Proprietor

- 6A (1) It shall be the duty of every proprietor of an industrial undertaking to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed by him at the industrial undertaking.
- (2) Without prejudice to the generality of a proprietor's duty under subsection (1), the matters to which that duty extends include in particular-
- (a) the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;
 - (b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;
 - (c) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed by him at the industrial undertaking;
 - (d) so far as is reasonably practicable as regards any part of the industrial undertaking under the proprietor's control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks; and



- (e) the provision and maintenance of a working environment for all persons employed by him at the industrial undertaking that is, so far as is reasonably practicable, safe, and without risks to health.

General Duties of Persons Employed

- 6B (1) It shall be the duty of every person employed at an industrial undertaking while at work-
- (a) to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and
 - (b) as regards any duty or requirement imposed on a proprietor of the industrial undertaking or on any other person by this Ordinance for securing health and safety of persons employed at the industrial undertaking, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.





Appendix II

ASPECTS WITH RESPECT TO PARTICULAR DIVING MODE A DIVER SHOULD HAVE TRAINING AND EXPERIENCE IN

1 SCUBA Air Diving

- (a) theory of air diving;
- (b) use of self-contained diving apparatus and equipment;
- (c) diving safely and competently in various conditions not exceeding 30 metres (100 feet) in depth, including the safe use of hand tools and hand-held power tools and equipment;
- (d) use of diver communication systems appropriate to air diving;
- (e) emergency procedures for air diving;
- (f) therapeutic recompression, and the decompression tables appropriate to air diving;
- (g) first aid appropriate to emergencies arising in air diving including cardio-pulmonary resuscitation and preferably, oxygen first aid;
- (h) relevant codes of practice and guidance.

2 Surface-supplied Air Diving

- (a) all matters specified for SCUBA air diving;
- (b) use of surface-supplied diving equipment;
- (c) operation of surface recompression chamber.

3 Mixed Gas or Bell Diving

- (a) all matters specified for surface-supplied air diving;
- (b) theory of mixed gas and bell diving;



- (c) use of the pressure gauges and timing devices essential to such diving mode;
- (d) use of gas supplying system;
- (e) diving safely and competently to representative depths exceeding 50 meters using a diving bell;
- (f) use of diver communication system appropriate to mixed gas and bell diving;
- (g) diving bell operation, transferring to surface recompression chamber, recompression on mixed gas and decompression procedures, and decompression tables appropriate to mixed gas diving;
- (h) emergency procedures for mixed gas and bell diving;
- (i) first aid appropriate to emergencies arising in mixed gas and bell diving;
- (j) codes of practice and guidance relevant to mixed gas and bell diving.





Appendix III

MEDICAL CERTIFICATE OF FITNESS TO DIVE

1 Initial (Pre-training) Examination

Initial medical examination should be conducted before a diver has commenced training by a medical practitioner preferably with special experience in underwater or occupational medicine. Investigations conducted during the examination should include:

- (a) chest X-ray, PA full inspiration and expiration;
- (b) full blood count, including haemoglobin and haematocrit;
- (c) audiometry;
- (d) lung function tests to include FVC and FEV₁;
- (e) exercise testing;
- (f) electrocardiography;
- (g) dipstick urinalysis;
- (h) long bone radiographs which need only be taken at initial examination for those divers working at depths exceeding 50 metres, and should be repeated only at the discretion of the examining medical practitioner; and
- (i) additional investigations which may be ordered at the discretion of the medical practitioner and specialist referral is appropriate in case of abnormal results.

2 Annual Medical Examination

At annual medical examination, investigations (c) to (g) in the above should be conducted. Additional investigations may be ordered at the discretion of the medical practitioner and specialist referral is appropriate in case of abnormal results.



3 Medical Certificate of Fitness to Dive

The medical certificate issued after the examination should contain:

- (a) name of person;
- (b) date of medical examination;
- (c) date and result of chest X-ray done at first medical examination;
- (d) date and result of long bone radiographs, if applicable;
- (e) results of investigations conducted;
- (f) any limitation on diving;
- (g) name, qualification, address and telephone number of the medical practitioner issuing the certificate; and
- (h) signature of the medical practitioner.



▶ Appendix IV

MATTERS IN RESPECT OF WHICH PROVISION IS TO BE MADE IN DIVING RULES

1 Planning

Consideration of:

- (a) meteorological conditions, including forecasted conditions;
- (b) tidal information including local tide tables and indications of speed of current to be expected;
- (c) proposed shipping movements;
- (d) potential boat traffic;
- (e) air and water temperatures;
- (f) underwater hazards of the diving site, including any culverts, penstocks, sluice valves or areas where differences in hydrostatic pressure may endanger the diver;
- (g) depth and type of operation;
- (h) suitability of plant and equipment;
- (i) availability and competence of personnel;
- (j) the need to fly after diving and the effect on a diver due to changes in air pressure if he flies after diving;
- (k) activities of any person who will be diving in connection with the diving operation whether or not he is a diver.

2 Preparations

- (a) consultation with persons having any control over or information related to the safety of any diving operations; and in particular persons having control of lifting appliances or having control of information about shipping movements;



- (b) selection of the breathing apparatus and mixture;
- (c) checking of plant and equipment;
- (d) allocation of personnel;
- (e) personal fitness of divers for underwater operations;
- (f) precautions against cold in and out of the water;
- (g) lifeline system, and means of communication and signalling procedures;
- (h) precautions against underwater hazards of the diving site.

3 Procedures during and after diving

- (a) responsibilities of diving supervisor, divers and surface support;
- (b) use of all types of personal diving equipment;
- (c) supply of gas and gas mixture, including maximum and minimum partial pressure of gases;
- (d) operations direct from an installation, work site or craft;
- (e) operations in relation to diving bell;
- (f) working in different locations;
- (g) operations and use of equipment underwater;
- (h) limits on depth and time underwater;
- (i) descent, ascent and recovery of divers or diving bell;
- (j) decompression tables for use in decompression procedures for both single and repetitive diving and in therapeutic recompression procedures;
- (k) control in changing conditions;
- (l) time for which divers are to remain in vicinity of the surface recompression chamber;
- (m) maintenance of log books.

4 Emergency procedures

- (a) emergency signalling;
- (b) emergency assistance underwater and on the surface;
- (c) therapeutic recompression, and the availability of recompression chamber for that purpose;



- (d) first aid;
- (e) medical assistance with telephone numbers;
- (f) calling assistance from emergency services (telephone numbers) including advance liaison with those services where appropriate;
- (g) precautions in the event of evacuation of the installation, work site, vessel, hovercraft or floating structure;
- (h) provision of emergency electrical supplies.



▶ Appendix V

SPECIFICATIONS OF PURITY FOR COMPRESSED AIR

Compressed air supplied to divers should not contain impurities in excess of the limits as follows :

Carbon monoxide	— 10 parts per million
Carbon dioxide	— 500 parts per million
Oil	— 1 mg/m ³
Water	— 0.5 g/m ³
Odour and Cleanliness	— The air should be free from all odour and contamination by dust, dirt and metallic particles and should not contain any other toxic ingredients.

Note: Odour and cleanliness of compressed air are difficult to check accurately without special equipment. A rough check may be made by opening the cylinder valve and smelling the escaping air and by noting any discolouration or retaining of moisture when the air is passed through a wad of tissue or filter paper.



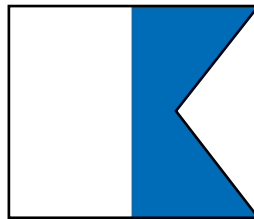


Appendix VI

DIVER DOWN FLAG AND THREE ALL-ROUND LIGHTS

1 Diver Down Flag

The "Diver Down Flag" acts as a warning signal to nearby or approaching vessels. The flag should comply with the International and Hong Kong Port Signals. It is a rigid replica of the International Code flag "A" with the meaning of "I have a diver down; keep well clear at slow speed", and is a white and blue flag of the following design:



The flag should be at least one metre in height. Measures should be taken to ensure its all-round visibility.

2 Three All-round Lights

The three all-round lights should be in a vertical line and displayed in a manner where they can best be seen. The highest and lowest of these lights should be red and the middle light white.





Appendix VII

SPECIFICATIONS FOR SURFACE RECOMPRESSION CHAMBER

A surface recompression chamber should :

- (a) have at least two compartments with doors each of which acts as a pressure seal and can be opened from either side (2-compartment chamber); or alternatively a single compartment chamber may be used under conditions specified in code 9.2;
- (b) in the case of 2-compartment chamber, have sufficient space in at least one of its compartments to enable two adults to lie down inside the chamber without difficulty and if the chamber is to be used in circumstances in which a person is intended to remain inside under pressure for a continuous period of 12 hours or more, excluding any therapeutic recompression, it shall have a minimum internal diameter of two metres;
- (c) where a diving bell is used, be capable of allowing a person to transfer under pressure from the bell to the surface recompression chamber and vice versa;
- (d) provide a suitable environment and suitable facilities for the persons who are to use it, having regard to the kind of operation in connection with which it is used and the period during which the pressure is raised;
- (e) be so designed as to minimize the risk of fire;
- (f) have a lock through which food and medical supplies may be passed into the chamber while its occupants remain under pressure;
- (g) be equipped with such valves, gauges and other fittings (which are to be made of suitable materials and so



designed as to minimize the noise inside the chamber during rapid pressurization) as are necessary to control and indicate the internal pressures of each compartment from outside the chamber;

- (h) be fitted with adequate equipment, including reserve facilities, for supplying and maintaining the appropriate breathing mixture to persons inside it;
- (i) be equipped with a 2-way voice communication system; and
- (j) have means for heating or cooling the chamber as appropriate and for lighting and have adequate first aid and sanitary facilities.





Appendix VIII

SPECIFICATIONS FOR DIVING BELL

A diving bell should :

- (a) be equipped with means by which each diver using the bell is able to enter and leave it without difficulty, and doors which act as pressure seals and which may be opened from either side;
- (b) be capable of allowing a person to transfer under pressure from it to a surface recompression chamber and vice versa;
- (c) be equipped with appropriate valves, gauges and other fittings, made of suitable materials, for controlling and indicating the pressure within the bell, and for indicating the external pressure on the bell to those inside the bell and to the diving supervisor;
- (d) be fitted with adequate equipment including console to monitor working depth and surfacing speed, and reserve facilities for supplying the appropriate breathing mixture to divers occupying or working from the bell;
- (e) be equipped with a 2-way voice communication system which enables the diver within the bell maintain contact with the team members at the diving location and with divers outside the bell;
- (f) be fitted with equipment for lighting and heating the bell;
- (g) contain adequate first aid facilities and be fitted with lifting equipment sufficient to enable an unconscious or injured diver to be hoisted into the bell by a person inside it;
- (h) be provided with means by which, in the event of any emergency, the bell can be rapidly located by through water signals from the stricken bell and the lives of trapped divers can be sustained for at least 24 hours or, where that is not practicable, sustained for as long as is practicable;



- (i) be used in association with lifting gear which enables the bell to be lowered to the depth from the diving location, maintained in its position and raised, in each case without excessive lateral, vertical or rotational movement taking place; and
- (j) be provided with a means by which, in the event of failure of the main lifting gear, the bell can be returned to the surface; if those means involve the shedding of weights, they should be capable of being shed from the bell by a diver inside it and a means should be incorporated to prevent their accidental shedding.



Appendix IX

MATTERS TO BE ENTERED IN DIVING OPERATIONS LOG BOOK

Matters to be entered in the Diving Operations Log Book in respect of each diving operation should include:

- (a) the name of the diving contractor;
- (b) the dates on which and the period during which the diving operation is carried out;
- (c) the name or other designation of the craft or work site in connection with which the diving operation is carried out and the location of that craft or work site;
- (d) the name of the diving supervisor and the period for which he is acting in that capacity in respect of that diving operation;
- (e) the names of the other persons engaged in the diving operation including those operating any diving plant or equipment and their respective duties;
- (f) the arrangements for emergency support;
- (g) the procedures followed in the course of the diving operation including details of the decompression schedule used;
- (h) the maximum depth reached in the course of the operation for each diver;
- (i) for each diver, in respect of each dive he makes, the time he leaves the surface, his bottom time and the time he reaches the surface;
- (j) the diving mode and type of breathing apparatus and mixture used;
- (k) the nature of the diving operation;
- (l) any decompression sickness, other illness, discomfort or injury suffered by any of the divers;



- (m) particulars of any emergency which occurred during the diving operation and any action taken;
- (n) any defects that are discovered in any plant or equipment used in the diving operation;
- (o) particulars of any environmental factors affecting the diving operation; and
- (p) any other factors relevant to the safety or health of the persons engaged in the operation.



▶ Appendix X

MATTERS TO BE ENTERED IN DIVER'S LOG BOOK

Matters to be entered in the personal Diver's Log Book in respect of each diving operation in which the diver takes part should include:

- (a) the name and address of the diving contractor;
- (b) the date;
- (c) the name, or other designation, and the location of the work site, craft or harbour from which the diving operation is carried out;
- (d) the name of the diving supervisor;
- (e) the maximum depth reached on each dive;
- (f) the time the diver leaves the surface, his bottom time and the time he reaches the surface in each dive;
- (g) where the dive involves decompression in a recompression chamber, details of any time spent outside the chamber at a different pressure;
- (h) the diving mode and type of breathing apparatus and mixture used;
- (i) any work done by the diver in each dive and the equipment (including tools) used by him in that work;
- (j) any decompression schedules followed in each dive;
- (k) any decompression sickness or other illness, discomfort or injury suffered; and
- (l) any other factor relevant to the diver's safety or health.

Note : The Diver's Log Book should contain also the diver's photograph and Medical Certificate of Fitness to Dive.





**Occupational Safety and Health Branch
Labour Department**