



An
Introduction
to
Diving Operations
Offshore

Compiled by
Paul Williams



An
Introduction
to
Diving Operations
Offshore

by
Paul Williams



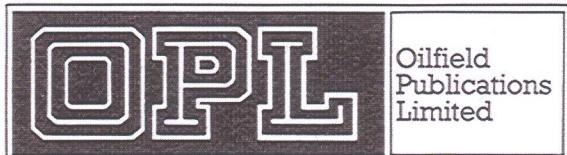
[®]Copyright

An Introduction to Diving Operations Offshore is the exclusive copyright of the publishers and may not be reproduced in whole or part without the written permission of Oilfield Publications Limited.

Re-ordering

Additional copies of this book may be obtained by contacting OPL direct at the address, telephone and fax numbers given at the foot of this page.

This book has been carefully prepared from the best existing sources of information available at the time of preparation but OPL do not guarantee the accuracy of the book nor of the limits, extent or position of any diagrammatic representation delineated thereon nor do OPL assume any responsibility or liability for any reliance thereon.



Homend House, PO Box 11, Ledbury, Herefordshire HR8 1BN, England
Tel: (01531) 634563 Fax: (01531) 634239

ISBN 1 870945 33 6

CONTENTS

The development of commercial diving	1
The first commercial divers	3
Early diving bells	4
The next 2000 years	5
Standard gear	6
The demand valve	7
Chambers and bells	8
Early research into decompression	8
Haldane's decompression tables	9
The first mixed gas dives	10
Sealab	11
Offshore diving	12
The future	13
The physics of diving	15
Gauge pressure and absolute pressure	17
How much gas does the diver use?	17
How long can the diver work for?	19
Surface supply compressors	22
Gas use in a an emergency	24
The effects of temperature	25
Partial Pressures	25
Choosing the right mix	26
The US Navy Partial Pressure Tables	29
Gas Mixing	30
Pressurising a chamber	31
Gas volumes for pressurisation	33
Daily gas use in the chamber	33
Adding oxygen to the chamber	34
Temperature changes	36
Bleeding the chamber	37
Chamber blow up	37
Chamber blow down	38
Lost bell	38
Diving physiology	41
Barotrauma	43
Ear problems	43
The sinuses	44
Dental barotrauma	44
Squeeze	45

Pulmonary Barotrauma	46
Pneumothorax	46
Interstitial emphysema	47
Arterial Gas Embolism (AGE)	47
Decompression sickness (DCS)	48
Type 1 DCS	49
Type 2 DCS	49
Dysbaric Osteonecrosis	50
High pressure nervous syndrome (HPNS)	51
Compression Arthralgia	51
Gas toxicity	51
Oxygen poisoning	51
Lack of Oxygen	53
Nitrogen	53
Carbon Dioxide	54
Carbon monoxide	54
Other contaminants	54
Hypothermia	55
Hyperthermia	55
Drowning	55
The diver's environment	57
Wind and tide	59
Pressure	61
Temperature	62
Light	64
Sound	65
Marine Life	66
Saturation Chambers	67
Legislation, guidance and training	71
The seventies	73
UK Regulations	74
The Diving Operations at Work Regulations	75
Diver Qualifications	78
Part I Divers	79
Part II Divers	80
Other qualifications	80
Diving equipment and systems	83
Personal Equipment	85
Air supplies	91
Air decompression chambers	93
Wet bells	95

Saturation diving systems	97
The diving bell	100
Bell handling systems	102
Dive support vessels	105
Dynamic Positioning	107
Taut Wire	107
Artemis Surface Reference System	109
Acoustic Reference System.	110
Inertial Navigation System	111
Minimum number of sensors	111
Assessment and operating checks	112
Communications	112
Vessel movements	112
DP Alerts	113
Yellow Alert	113
Red Alert	114
Jacuzzi Effect	115
Surface Orientated Diving from DP Vessels	115
Diving procedures	119
Introduction	121
Communications	122
Air and gas supplies	126
Decompression procedures	127
Scuba diving	131
Surface supplied diving	132
Wet bell diving	133
Bounce diving	134
Saturation diving	135
Living in saturation	139
Working with ROVs	141
Diving gas supplies	143
Gas handling	145
Gas Analysis	147
Gas mixing	149
Diver gas recovery systems	149
Chamber gas recovery	152
Hazards and emergencies	155
Poor visibility	157
Current	158
Bad Sea States	158

Temperature	159
Suction and seabed debris	160
Confined spaces	161
Sonar	162
Seismic operations	162
Remotely operated vehicles	162
Electrical hazards	162
Cutting	163
Power tools	164
Water jets	165
Explosives	165
Epoxy resins	166
Inert gases	167
Oxygen	167
Chamber flushing	168
Other hazards	168
Air diving	168
Bell diving emergencies - the diver	169
Bell diving emergencies - the bell	170
Chamber emergencies	172
Hyperbaric evacuation	174

Managing a diving operation	177
Placing the contract	179
Duties and responsibilities	179
Reports and record keeping	180
Emergency procedures	181
Incident and accident reporting	181
Serious accidents and fatalities	181

Appendices

Appendix 1 - United Kingdom diving regulations	183
Appendix 2 - UK Department of Energy Safety Memos	201
Appendix 3 - Norwegian Diving Regulations	215
Appendix 4 - Norwegian Safety Notices	231
Appendix 5 - AODC and DMAC Guidance notes	235
Appendix 6 - Formulae for diving calculations	241
Appendix 7 - Depth and pressure	247
Appendix 8 - Units of measure	251
Appendix 9 - Colour coding of gas cylinders	255
Appendix 10 - Glossary	259

Index	269
--------------------	------------



NATIONAL HYPERBARIC CENTRE

The National Hyperbaric Centre is an independent, privately owned, test, R&D, training and engineering establishment located in Aberdeen.

The Centre offers its services to industry within the following fields:

EMERGENCY SERVICES:

- Provision of emergency services to health authorities including treatment of injured divers or other personnel requiring therapeutic oxygen treatment.
- Operation of Transfer Under Pressure (TUP) equipment on behalf of a group of operators.
- Provision of receipt facilities for Hyperbaric Lifeboats (HLB).

TESTING:

- Pressure and function testing of underwater equipment in wet or dry conditions down to the equivalent of 1,000 metres of seawater.
- Testing of aerospace equipment up to an altitude equivalent to 50,000 metres.

PROCEDURE VERIFICATION:

- Verification of welding and NDT procedures.

RESEARCH AND DEVELOPMENT (R&D):

- Management of R&D activities.
- Development of manned or unmanned intervention techniques including equipment and robotics.

ENGINEERING AND INSPECTION SERVICES:

- Development of inspection programmes including provision of inspection personnel.
- Safety (FMEA and HAZOP) studies.

TRAINING:

Diver First Aid Training

On 29th April 1991, the Diving Operations at Work (Amendment) Regulations 1990 (SI996) will come into force, introducing, among other things, a revision of First Aid requirements for divers. It requires that all HSE approved divers must hold an HSE approved First Aid qualification by 29th April 1993.

To meet these requirements the NHCL and RGIT have combined to offer a full range of diver First Aid and diver medic qualification and refresher courses.

Mixed Gas Diver Training

In the late Autumn of this year, NHCL will run this course in conjunction with The Underwater Training Centre. The 21 day course will be run primarily on a modern DSV with some classwork to be conducted in Aberdeen.

AODC Supervisor Courses

These two training courses, Assistant Air Supervisor and Assistant Bell Supervisor, are designed as a basic course for new entrants to the AODC Supervisors Scheme and as a refresher for experienced Supervisors. The courses are run in strict adherence to the guidelines laid down by the AODC.

Assistant LST Course

This training course is designed as a basic course for new entrants to the AODC Life Support Technician Scheme.

CSWIP 3.2U

(From late 1991)
Training of diving personnel to CSWIP 3.2U standard.

CSWIP 3.4U

This course is run in conjunction with MOM and was the first course to gain the all important CSWIP approval. Over one hundred inspection controllers have now successfully completed the course.

Diving Familiarisation Course

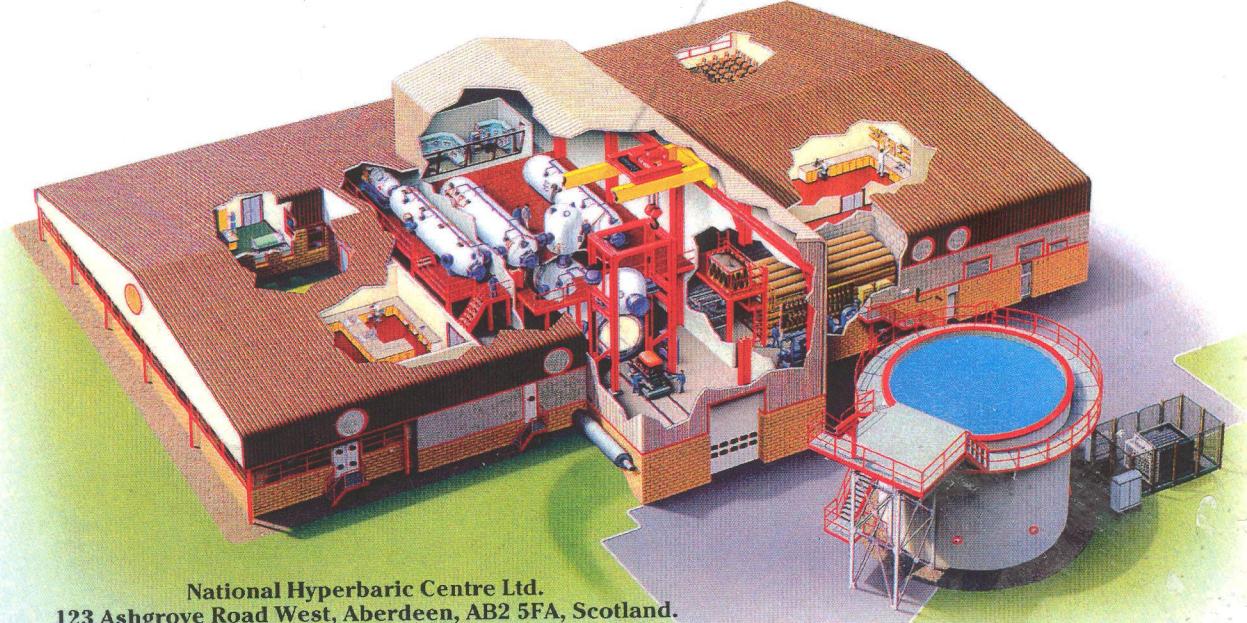
A 2 day course designed to provide an insight into diving operational techniques. This course is aimed at company representatives, and non-diving personnel in general.

ROV Pilot/Technician Course

This is an introductory training course for new ROV Pilot/Technicians which has been produced to provide a thorough background in general offshore and ROV operations, safety procedures, repair and maintenance etc.

OTHER COURSES:

NHCL can at short notice tailor-make courses taking account of the student's background and the requirements.



National Hyperbaric Centre Ltd.

123 Ashgrove Road West, Aberdeen, AB2 5FA, Scotland.
Telephone: (0224) 698895 Telex: 739171 NHCLG Fax: (0224) 692222