**AS/NZS 2299.1:2007**

**3.12.3   Use of oxygen in decompression procedures**

This Standard does not cover the use of 100% oxygen as a breathing gas underwater.

Where EAN is being used, decompression may take place using the EAN mix used during the dive. In some instances it may also be desirable to have air available as an alternative to the EAN mixture for the purpose of in-water decompression in an emergency situation, such as a case of oxygen toxicity.

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| DRAFTING NOTE: It was noted by the committee that past versions of this standard did not provide guidance in the use of in-water O2 during diving, either as the main breathing supply or for use for in-water decompression. It was further noted that this method of diving is currently used in certain sectors and that the inclusion of guidance in this Standard might therefore be helpful. There are already a number of differing military, commercial and industry guidelines and tables for in water oxygen use. Comment is sought in relation to whether in-water O2 procedures should be incorporated into this standard and if so, whether there are any preferred procedures. |

**3.12.5   Multi-level diving**

A multi-level dive is a dive during which the bottom time is spent at two or more depths given in the tables. These dives should be undertaken with great care as the risk of decompression sickness may be higher in some cases than for dives to a fixed depth.

Multi-level diving shall be undertaken in accordance with the tables being used. When calculating decompression for multi-level users shall not use a mixture of algorithms, tables and or procedures for any one series of dives.

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| DRAFTING NOTE: Comment is sought on the inclusion of guidance pertaining to the use of Multi-level Dive tables.  There is the potential for misuse and exploitation where the total dive-time is continually re-calculated using the multi-level dive table during a profile to deliberately far exceed the total dive-time when compared to a repetitive dive table calculation for the same maximum depth. |

**4.4   TESTING**

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| DRAFTING NOTE: Public comment is specifically sought on the various aspects of this section on breathing gas quality and testing. Internationally, there are a range of standards and practices which vary somewhat from the requirements of this Draft Standard and from AS/NZS 2299.1 (2007). Some other standards are currently being revised and should be available by the time this Draft Standard is being finalised. Specific issues include the following:  a)        Some juriedictions require independent laboratory testing of breathing gas. This was considered ideal, but impractical for Australia and New Zealand, and this is reflected in the draft wording.  b)        The previous CO2 level allowed is no longer practical as a result of increasing atmospheric CO2 levels globally. CO2 levels up to 1000 ppm are probably without health risk for divers, and the Australian Navy has adopted a level of 800 ppm. This draft has selected a 600 ppm level as sufficient to solve the problem of high atmospheric CO2 levels, whilst still remaining relatively low to provide surety against contamination by engine exhausts that might carry with them other contaminants|  c)        Whilst there is universal agreement about the need to prevent carbon monoxide toxicity, there is debate about the dangers of very low level exposure, with proposals for breathing air limits from as low as 2-3 ppm whilst others feel that up to 10 ppm is quite safe for divers. Safework Australia’s limit for a full 8 hour working shift at atmospheric pressure is 30 ppm, whilst 60 ppm is allowable for exposures not exceeding 60 minutes and 100 ppm for exposures up to 30 minutes. A commonly adopted safety factor for air purity for dives up to 50 MSW is to divide the allowable surface exposure by a factor of 10. This would suggest a level of 10ppm is safe for most diving scenarios, but the drafting group selected 8ppm in order to add some safety. A level of 5ppm could easily be supported as providing an extra safety factor, in part on the same basis that a low level of CO2 was chosen – that is as an easily measured indicator to minimize the risk of there being other contaminants that are harder to measure, such as volatile hydrocarbons or oxides of sulphur or nitrogen etc.  The level of 5 ppm was selected for “oxygen compatible air” for this reason, and the level of 5 ppm was also chosen for EAN, as EAN should never have higher contaminant levels than oxygen compatible air.  d)        Water contamination recommendations are essentially unchanged but tables of mg/m3 limits have been added to the functional requirement to have a sufficiently low dewpoint that was previously the only guidance given. Moister air is desirable rather than problematic from a respiratory health point of view and moisture content limits for divers air are purely for safety and equipment related reasons.  e)        Australian and New Zealand diver’s air standards have not traditionally included limits for particulates on the basis that the air is assumed to have been filtered sufficiently to prevent such problems. This tradition has been continued, although most standards for surface air quality include particulate limits.  f)        There are many other toxic compounds of interest that can potentially contaminate divers air and create either short term risks such as loss of consciousness, impaired judgement or cardiac arrhythmias, or long term health consequences. These include low molecular weight volatile hydrocarbons (such as paint thinners, petroleum products), alcohols, fluorine or chlorine containing compounds (e.g. from breakdown of seals or lining materials) and many others. These can be detected by appropriate laboratory equipment, and there is increasing availability of medium cost, semi-analytical instruments for field use. Although it would be ideal to have all divers air monitored by such equipment, this was not felt to be justified at this time. The drafting group therefore increased the strength of recommendation for laboratory grade analysis, but has continued to rely, as in the past, on the safety factors of good practice in air compression, CO2, CO and oil analysis, and a subjective test for odour. As divers air (and EAN) delivered through flexible hoses and regulators tends to have some low grade odour related to these materials, the term “no objectionable or nauseous odour” has been retained as many potentially toxic compounds have readily detected odour. The term “no detectable odour” has been selected for Oxygen Compatible Air on the basis that this provides a higher standard for air supplied directly from cylinders or a compressor, after filtration and before passing through diving equipment. |

**5.1.4   Risk management for diving without a dive site chamber**

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| DRAFTING NOTE: Whilst this section is based upon the principals of the current standard, it has been reworked to allow for the inclusion of enriched air nitrox and/or the use of tables and procedures other than DCIEM.  The maximum times in the shallower depth range have been limited to provide a safety margin beyond just decompression based limits, given the potential hazards of very long duration underwater work. |

 Also see

Where multiple dives are undertaken on one day, residual nitrogen times from previous dives shall be taken into account in calculating the time allowable for a subsequent dive. Any significant risk-increasing factor (e.g. cold stress or hard work) should lead to further shortening of dive times or extra safety time. Divers should carry out a precautionary safety stop at the end of each dive.

Depending upon the availability of emergency recompression, diving shall be limited as follows:

(a)        Dive duration limits where recompression is available within 2 h

Where recompression is available within 2 h of the dive site, the maximum bottom time for any single dive shall be the No Decompression Limit (NDL) times for the decompression tables and procedures in use, provided that, the maximum time in the water for any one dive does not exceed those listed in Table 5.1 for the appropriate depth.

(b)        Dive duration limits where recompression availability exceeds 2 h

Where recompression availability exceeds 2 h travel from the dive site, the maximum bottom time for any single dive shall be 80% of the No Decompression Limit (NDL) times for the decompression tables and procedures in use, provided that, the maximum time in the water for any one dive does not exceed those listed in Table 5.2 for the appropriate depth.

TABLE   5.1

MAXIMUM TIME LIMITS FOR DIVES   
UNDERTAKEN WITH RECOMPRESSION   
CHAMBER SUPPORT IS AVAILABLE WITHIN 2 H

|  |  |  |
| --- | --- | --- |
| Maximum dive depth | Maximum dive time, min | |
| m | Single dive (per day) | Multiple dives |
| 6 9 >9 | 480 240 150 | 360 190 120 |

TABLE   5.2

MAXIMUM TIME LIMITS FOR   
DIVES UNDERTAKEN WERE   
RECOMPRESSION CHAMBER SUPPORT EXCEEDS 2 H

|  |  |  |
| --- | --- | --- |
| Maximum dive depth | Maximum dive time, min | |
| m | Single dive (per day) | Multiple dives |
| 6 9 >9 | 300 180 120 | 240 150 90 |
| NOTE: All repetitive dives undertaken without a recompression chamber on site should be undertaken with an increased level of caution. | | |