

Tables of shortening of no-deco-limits for older divers

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INTRODUCTION

Dive tables and dive computers have been developed for young, very fit divers, often marine divers. But recreational divers are not always young and do not have always a good condition. The proportion of recreational divers older than 50 years steadily increases. After most dives, nitrogen bubbles arise, especially in older and in non-optimal fit divers. These bubbles may cause decompression sickness and permanent (neurological) **disorders**.

Many dive computers have a so-called personal setting, often implemented as a light and a heavy (more save) option, which reduce the no-deco-limits and lengthen and deepen deco-stops. Other computers have so-called micro-bubble settings which produce the same effects. However, in none of the tested dive computers **a reduction of diving depth** was implemented and this is exactly what **is most effective**. Therefore the Foundation of Dive Research (Stichting Duik Research (SDR)) has developed a method to enable divers older than 35 years and divers with a non-optimal condition to perform save dives with a dive computer. Save for recreational divers means a risk on decompression sickness of 1% of all no-deco-dives at the transition of deco-dives. But without extra measures older and non-optimal fit divers have a risk much larger than 1%.

The risk on decompression sickness can be reduced substantially by:

1. **diminishing of the maximal diving depth, and;**
2. **shorting of no-deco-limits.**

This means that you have to subtract a particular time, the correction (or penalty) time from the no-deco-limit of your dive table or dive computer. This correction time is dependent on your age and aerobic condition but also on the maximal diving depth (MDD).¹

The correction times are based on scientific investigations of the occurrence of bubbles in the circulation after diving. The background of this protocol has been described in *Achtergronden van een theoretisch model over het risico op decompressieziekte met leeftijd, geslacht, VO_{2max} en lichaamsvetpercentage als parameters. Is een correctie van de nultijd mogelijk? Met speciale aandacht voor vet% en VO_{2max}* and later the theory was developed further in "Een nieuwe methode om de nultijd bij te stellen op basis van leeftijd, aerobe conditie en diepte" see www.duikresearch.org/Publicaties. See also www.duikgeneeskunde.nl/Literatuur.

CONDITIONS AND POSSIBILITIES OF APPLICATION

Dive computers to be used:

- Suunto's with RGBM. (According to present standards, the other, older types of Suunto's are not sufficiently safe.)
- UWATEC's of the Aladin® series. (According to present standards, the old Aladin Pro is not sufficiently safe) and all later types, such as Smart, Galileo.
- Mares computers with RGBM. (Older types are not totally reliable.)
- Trac (Scubapro),
- Aqua Lab (Seac Sub).

NB According to the present standards, the in the Netherlands and Belgium infrequently used Dive Mate, XR2 (Aeris), Oceanic prodigy, Sherwood (Source) are not sufficiently safe.

¹ Disclaimer Although every reduction of MDD and shortening of no-deco-limits of a dive table or dive computer creates a more save dive, application of the correction tables is for own risk (SDR and author cannot be taken responsible).

The method holds for:

- the default setting of the so called personal setting (P0-setting of Suunto's and Mares's) and that of the micro-bubble setting (setting 0 of UWATECs). THIS DEFAULT SETTING OF YOUR DIVE COMPUTER MUST BE USED, SINCE THE TABLES 1-6 HAVE EXPLICITLY BEEN TO IMPLY AGE AND CONDITION.
- non-deco dives until at most 45 m;
- air- and Nitrox dives;
- altitude diving (dive computer in some altitude setting);

EXPLANATION OF THE USE OF THE TABLES**STEP 1 DETERMINE WITH TABLE A (P. 3) WHICH CORRECTION TABLE APPLIES TO YOU**

Table A holds for a regular dive with respect to water temperature, current and visibility.

For heavy conditions, increase your age with 5 years and for very heavy conditions (strong current, extreme cold) increase with 10 year. Next, determine the table which holds.

STEP 2 PRECEDING THE DIVE, CHOICE MDD.**STEP 3 APPLY ONE OF THE CORRECTION TABLES 1 TO 6 (P. 3 AND 4).²**

CLARIFICATION As long as *no-deco-limit of the DC minus correction time* yields some minutes you stay at the current depth, but **as soon as the no-deco-limit is equal to the correction time you must ascent**. In other words, the correction times are the minimal no-deco-limits on your computer display you have to respect. When this number of minutes is smaller, then, in accordance with the correction table, you are "in deco". Then ascent immediately and such that as soon as possibly at some new depth the number of minutes of no-deco-limit on your computer match the number of the correction table.

An example of use

Suppose, you are 38 years, you have once a week 1 hour of swim-training and you are running once a week 20 minute. That is 80 min/week aerobic sports activity, rounded 1 hour. Then, according to Table A, Table 1 applies to you.

Now, you like to make a non-deco dive to 41 m. We will see what Table 1 prescribes.

Table 1 Correction times with various MMD and depths of ascent for age 35-49 years, condition moderate

	CORRECTION TIMES (min)			
MDD (m) →	36	39	42	45
depth at ascent (m)				
from 7 until 20	0	5	5	11
from 20 until 30	0	2	2	4
from 30 until 45	0	1	1	2

45 m is the maximal allowed depth.

According to column "42 m" of Table, at the actual depth of 41 m you must have on the dive computer display a non-deco-limit of at least 1 min. This holds up to 30 m. Between 20 and 30 m this critical time is 2 min and up to 20m this is 5 min.

HENCE, YOU HAVE TO LEARN BY HEAD ALWAYS 3 TIMES TO SHORTHEN:

- **DEEPER THAN 30 M,**
- **BETWEEN 20 AND 30 M**
- **DEEPER THAN 20 M.**

As the tables show, the times of shortening often change irregular. In practise, you will learn soon to imply this times more smoothly by also applying times in between the values of the column (so called interpolation).

² The numbers of the table have no definit or eternal meaning. More research can change the precise value of the numbers. Despite this, it will always hold that with increasing age MDD must be lowered and that non-deco-limits must be shortened. and moreover that during the ascent the no-deco-limits of the computer must be lowered.

TABELS

Table A

Age (age)	Hours aerobic sport*/ week. Recreational** activity counts for half but 1 st hour does not count.	condition	action
34 and <	none	bad	medical examiner
	1 hour or more	at least moderate	no correction
35-49	none	bad	medical examiner
	1 hour	moderate	Table 1
	more than 1.5 hour	at least reasonable	no correction
50-64	none	bad	medical examiner
	1 hour	moderate	Table 2
	more than 1.5 hour	reasonable or good	Table 3
	minimal 6 hour heavy	very good	Table 4
65-79	1 hour or less	bad	medical examiner
	0.5 hour light and at least 1 hour heavy	moderate up to good	Table 5
	minimal 3 hours light and 1 hour heavy	very good	Table 6

*Aerobic sport (, race-cycling, swim training, rowing etc.) has a competitive character; hence it is for example not recreational cycling.

** 2 hours recreational cycling is equivalent to $(2-1) \times 0.5 = 0.5$ hour.

Table 1 Correction times with various MMD and depths of ascent for age 35-49 years, condition moderate

MDD (m) →	CORRECTION TIMES (min)			
	36	39	42	45
depth at ascent (m)				
from 7 until 20	0	5	5	11
from 20 until 30	0	2	2	4
from 30 until 45	0	1	1	2

Explanation: the table has been calculated for an age of 42.5 year. When you are close to 50 years, do not practise the table at its limits. In other words, do not apply the highest value of MDD that is allowed according to the table, but take a value of 3 or 6 m less and apply plentifully the correction times.

Table 2 Correction times with various MMD and depths of ascent for age 50-64 years, condition moderate

MDD (m) →	CORRECTION TIMES (min)							
	15	18	21	24	27	30	33	36
depth at ascent (m)								
from 7 until 20	0	5	5	11	17	25	32	32
from 20 until 30	0	0	2	5	7	10	13	13
from 30 until 45	0	0	0	0	0	7	7	7

Explanation: the table has been calculated for an age of 57.5 year. When you are 60+, do not go to the limits of the table. See also explanation of Table 1.

Table 3 Correction times with various MMD and depths of ascent for age 50-64 years, condition reasonable to good

	CORRECTION TIMES (min)						
MDD (m) →	21	24	27	30	33	36	39
depth at ascent (m)							
from 7 until 20	0	5	11	11	17	25	25
from 20 until 30	0	2	4	4	7	10	10
from 30 until 39	0	0	0	3	5	6	6

See also explanation of Table 2.

Table 4 Correction times with various MMD and depths of ascent for age 50-64 years, condition very good

	CORRECTION TIMES (min)					
MDD (m) →	27	30	33	36	39	42
depth at ascent (m)						
from 7 until 20	0	5	11	11	17	17
from 20 until 30	0	2	4	4	7	7
from 30 until 42	0	0	3	3	4	4

See also explanation of Table 2.

Table 5 Correction times with various MMD and depths of ascent for age 65-80 years, condition reasonable to good

	CORRECTION TIMES (min)							
MDD (m) →	6	9	12	15	18	21	24	27
depth at ascent (m)								
from 7 until 20	0	8	14	19	25	32	41	41
from 20 until 27	0	0	0	0	0	15	18	16

NOTICE:

if you are **older than 73 years then the following is of great importance:**

Explanation: the table has been calculated for an age of 72.5 year. It is strongly recommended that older divers apply even more restrictions. For instance, an 80-year old diver should not go deeper than about 15 m. Not only the risk of decompression sickness, but also the risk of heart failure and deterioration of the lung function increases progressively above 70 years.

Table 6 Correction times with various MMD and depths of ascent for age 65-80 years, condition very good

	CORRECTION TIMES (min)							
MDD (m) →	6	9	12	15	18	21	24	27
depth at ascent (m)								
from 7 until 20	0	7	7	12	17	25	32	41
from 20 until 27	0	0	0	0	0	12	14	16

NOTICE:

if you are **older than 73 years**, see note under Table 5.