

Absolutely Risky Business

Though regularly conducted by a small number of commercial operators using saturation systems, diving to 1000 f/307 m is risky business. Only a handful of surface-to-surface “bounce” dives have ever been conducted to these depths, and no one has ever done the dive on open-circuit scuba. Not surprising; there are an extraordinary number of factors that must be taken into account in order to survive. Here are a few, as reflected in the Zacatón table.

Gas planning is always a fundamental issue with scuba especially on deep dives. At 30-plus atmospheres, an aluminum 80 will only last a few minutes, and small variations in breathing and/or descent/ascent rates can have dramatic implications. An unpredicted increase in gas consumption nearly cost Bowden his life on his this prior 94APR dive to 925 f/284 m; an extra 80 cf stage cylinder saved it. Estimated gas consumption for the dive is nearly 1300 cubic feet. For his next attempt, Bowden plans to carry eight cylinders, and pre-stage the remaining cylinders needed so that he is able to abort the dive anywhere along the way down.

Then there's oxygen. If the O₂ levels are run too low, in-water decompression times become too long, making the dive impossible on scuba. Conversely, if they're too high, the diver runs the risk of a CNS hit and drowning. The risk increases with physical exertion due to increased CO₂ levels. The length of the dive also raises issues of whole body oxygen toxicity. Bowden is willing to tolerate short PO₂s of up to 2.0 atm during gas switches, based on an ultra-low exertion rate and his and Sheck Exley's past experience on extreme deep dives. [Technical community standards are to run oxygen levels at less than 1.5 atm during the working phase of the dive with a maximum PO₂ of 1.6 during decompression, see “Blueprint For Survival,” N6]. To increase his safety and comfort, he wore a full-face mask during his oxygen decompression on previous dives, and will use a decompression habitat or “microbell” next year.

Rapid compressions beyond about 400-600 f/123-184 m can result in High Pressure Nervous Syndrome (HPNS) producing tremors, nausea, and more. Sheck Exley experienced HPNS during his Bushmansgat's dive to 863 ffw/257 m. One solution is to run nitrogen levels as high as tolerable [See “HPNS” by RW Bill Hamilton, N8] in order to ameliorate the effect, but how gooned do you really want to be that far down? Note from the table that there are numerous points in the dive where “equivalent narcotic depths” (END) will be as high as 300 f/92 m. In addition to his prior mix dives at Zacatón, Bowden has conducted multiple work-up dives on air to 300 foot plus in order to test the effects of density on his regulators, build confidence, and condition himself to the high narcosis levels he is running. One atm practice with Johnny Walker Black Label may help as well. It is interesting to note that a shot of whisky was one of the first remedies for HPNS.

The risk of decompression illness is always an issue on tech dives. On his last dive, Bowden “padded” his table by switching back to his travel mix (trimix 10.5/50) from bottom mix (trimix 6.4/69.5, i.e. heliair 69.5) at his first stop at 480 f/147 m, and then breathed trimix 14/33 (heliair 14) at 300 f/92 m until his first “air stop” at 260/80 m. This strategy was intended to boost O₂ levels to improve decompression and to minimize the narcotic impact (and possible loss of consciousness) of switching directly from bottom mix to air at 260 f/80 m [Equivalent to an instant descent from about 60 f/18 m to 260 f/80 m. Bong.—ed]. Bowden is concerned about the impact of the increased nitrogen he'll be absorbing, but believes that it is more important to reduce helium levels ASAP. He then breathed argox 70 (70% O₂, 30% AR) in place of EAN 70 at his 30 f/9 m stop, and normoxic argox (21% O₂, bal AR) during the swim out of the system, in an effort to maximize off-loading from both N₂ and He. Dehydration is also a surprisingly crucial issue on the ten hour dive: “You just can't drink enough.” And dehydration escalates decompression risk; hence, his plans for rehydrating with an IV while sitting cozy in the microbell.

Plan to bone up for that thousand-foot dive? Go hit the books. Bowden confesses, “I carry Bennett & Elliot [The Physiology and Medicine of Diving] to the bathroom every night and read it over and over again. I like the fact that the authors remind you throughout the book—for those who are listening—that there are no absolutes.” Absolutely. You just can't afford to have a bad day. MZ

Zacatón

1000 fsw/307 msw/12 min. bottom time
Computed with Dr. X Version 5.01

Descent Plan:

Descent rate should not exceed 100 fsw per min.

Step 1 is 2 1/2 minutes to 300 fsw* / 92 m on air.

Required gas volume = 12.5 cf, CNS% = 100%, PO2 = 2.12, OTU = 8.

The amount of narcosis (END) at 300 fsw is 300 fsw / 92 m.

Step 2 is 2 1/2 min. to 600 fsw* / 184 m on trimix 10.5/50 (10.5% O2, 50% HE, 39.5% N2) .

Required gas volume = 32.9 cf, CNS% = 100%, PO2 = 2.01, OTU = 7.

The amount of narcosis (END) at 600 fsw is 283 fsw / 87 m.

Step 3 is 7 min. to 1000 fsw* / 307 m on trimix 6.4/69.5 (6.4% O2, 69.5% HE, 24.1% N2).

Required gas volume = 175.4 cf, CNS% = 100%, PO2 = 2.00, OTU = 19.

The amount of narcosis (END) at 1000 fsw is 282 fsw / 87 m.

WARNING:
This table has been published for informational purposes only. The dive represented is dangerous and beyond the scope of sport diving. Don't try this at home kids.

depth	stop time (cu ft)	runtime	deco mix	volume	PO2	CNS%	OTU	Cumulative OTUS
0 fsw	—	0 min	—	—	.021		0	0
1000 fsw	12 min	12 min	(see above for descent summary)	—				34
Ascent	6 min	18 min	TX 6.4/69.5	126.5 cf	1.50	5	12	46
480 fsw	6 min	24 min	TX 6.4/69.5	56.0 cf	0.99	2	7	53
430 fsw	3 min	27 min	TX 6.4/69.5	25.3 cf	0.90	1	3	56
420 fsw	1 min	28 min	TX 6.4/69.5	8.2 cf	0.88	0	2	58
410 fsw	1 min	29 min	TX 6.4/69.5	8.1 cf	0.86	0	2	60
400 fsw	1 min	30 min	TX 6.4/69.5	7.9 cf	0.84	0	2	62
390 fsw	1 min	31 min	TX 6.4/69.5	7.7 cf	0.82	0	2	64
380 fsw	1 min	32 min	TX 6.4/69.5	7.5 cf	0.80	0	2	66
370 fsw	1 min	33 min	TX 6.4/69.5	7.3 cf	0.78	0	2	68
360 fsw	1 min	34 min	TX 6.4/69.5	7.1 cf	0.76	0	2	70
350 fsw	2 min	36 min	TX 6.4/69.5	13.9 cf	0.74	0	2	72
340 fsw	1 min	37 min	TX 6.4/69.5	6.8 cf	0.72	0	1	73
330 fsw	2 min	39 min	TX 6.4/69.5	13.2 cf	0.70	0	2	75
320 fsw	2 min	41 min	TX 6.4/69.5	12.8 cf	0.68	0	2	77
310 fsw	2 min	43 min	TX 6.4/69.5	12.5 cf	0.67	0	2	79
300 fsw	2 min	45 min	TX 6.4/69.5	12.1 cf	0.65	0	2	81
290 fsw	3 min	48 min	TX 6.4/69.5	17.6 cf	0.63	0	2	83
280 fsw	3 min	51 min	TX 6.4/69.5	17.1 cf	0.61	0	2	85
270 fsw	4 min	55 min	TX 6.4/69.5	22.0 cf	0.59	1	2	87
260 fsw	1 min	56 min	AIR	5.3 cf	1.86*	100	3	90
250 fsw	2 min	58 min	AIR	10.3 cf	1.80*	100	5	95
240 fsw	1 min	59 min	AIR	5.0 cf	1.74*	100	3	98
230 fsw	2 min	61 min	AIR	9.6 cf	1.67*	100	5	103
220 fsw	2 min	63 min	AIR	9.2 cf	1.61*	4	5	108
210 fsw	2 min	65 min	AIR	8.8 cf	1.55*	2	5	113
200 fsw	2 min	67 min	AIR	8.5 cf	1.48	2	5	118
190 fsw	3 min	70 min	AIR	12.2 cf	1.42	2	6	124
180 fsw	3 min	73 min	AIR	11.6 cf	1.36	2	6	130
170 fsw	4 min	77 min	AIR	14.8 cf	1.29	2	7	137
160 fsw	5 min	82 min	AIR	17.5 cf	1.23	2	8	145
150 fsw	5 min	87 min	AIR	16.6 cf	1.16	2	8	153
140 fsw	5 min	92 min	AIR	15.7 cf	1.10	2	7	160
130 fsw	5 min	97 min	EAN 30	14.8 cf	1.48	4	10	170
120 fsw	7 min	104 min	EAN 30	19.5 cf	1.39	5	12	182
110 fsw	9 min	113 min	EAN 30	23.4 cf	1.30	5	14	196
100 fsw	12 min	125 min	EAN 30	29.0 cf	1.21	6	17	213
90 fsw	14 min	139 min	EAN30	31.3 cf	1.12	6	17	230
80 fsw	16 min	155 min	EAN 30	32.9 cf	1.03	5	17	247
70 fsw	19 min	174 min	EAN 30	35.6 cf	0.94	5	17	264
60 fsw	37 min	211 min	EAN 50	62.6 cf	1.41*	25	61	325
50 fsw	43 min	254 min	EAN 50	64.9 cf	1.26*	24	65	390
40 fsw	54 min	308 min	EAN 50	71.7 cf	1.11*	23	64	454
30 fsw	66 min	374 min	EAN 70	75.6 cf	1.34*	37	99	553
20 fsw	84 min	458 min	O2	80.9 cf	1.59*	187	163	716
10 fsw	136 min	594 min	O2	106.3 cf	1.29*	76	202	918
Ascent:	576 min			1056.7 cf				
Total dive:	594 min			1277 cf		1137%	918	

TX 6.4/69.5= trimix 6.4% O2, 69.5 He, 24.1% N2= heliair 6.4
Surface breathing rates are: swimming = 0.6 cf / min, deco = 0.4 cf / min.

Ascend at 100 fsw per min. to first stop. This ascent rate is highly DANGEROUS.
Deco safety factor is 0% (adjusted Buhlmann time is 7 min.).
WARNING! The deco safety factor is less than recommended.
Travel time between stops at 33 fsw per min. is included in the next stop time.
A one minute emergency ascent to 850 fsw from 1000 fsw is possible.

*** There is a high risk of CNS O2 toxicity where the PO2 is marked with " *".**
WARNING! This dive exceeds pulmonary O2 toxicity limits of 615 otus.

Note that this table is based on Bowden's APR94 dive to 925 f / 284 m and subsequent revisions and calculations.