



US Navy Decompression Tables and Procedures, Part One

Presented by the NOAA Diving Center
Seattle, Washington



Global View

- Table development
- Definitions
- Rules
- No-decompression limits and Repetitive Group Designation table
- Residual nitrogen timetables
- Diagramming dives



Introduction-1

- What are decompression tables?
 - Depth and time limits used to plan and conduct dives in such a manner as to reduce the probability of decompression sickness.
 - Decompression tables take into consideration the amount of nitrogen absorbed by the body at various depths and times.
 - Other considerations are the allowable pressure gradients which can exist without excessive bubble formation and different gas elimination rates associated with various body tissues.



Introduction-2

- Development of the USN Decompression tables
 - 1915: First set of decompression tables developed by French and Stillson for the USN Bureau of Construction and Repair
 - 1935: Second generation tables developed by Hawkins, Shillings, and Hanson
 - 1937: Third generation tables developed by Yarborough
 - 1951: Fourth generation developed by Van Der Aue
 - 1956: Fifth generation tables developed by Des Granger, Dwyer, and Workman developed with a UNIVAC computer and tested with approximately 600 man-dives at the USN EDU



Introduction-3

- Development of the USN Decompression tables Con't.
 - 1993: New probabilistic (versus deterministic) tables developed, but rejected by Naval Sea System Command (too conservative)
 - 1999: Latest version of USN Air Decompression Tables released. Includes new tables for traveling to altitude following dives
 - Future: New Nitrox Tables are being developed



Table Definitions-1

- Depth: Maximum depth attained during a dive
- Actual Bottom Time (ABT): Time from leaving surface until beginning a direct ascent to the surface
- Decompression: Process of eliminating nitrogen from the body during ascent
 - Linear: One continuous ascent without stopping
 - Staged: Stops for specific times at specific depths during ascent
- No-Decompression limits: Maximum time that can be spent at a given depth without requiring staged decompression



Table Definitions-2

- Decompression schedule: List of decompression stops for a particular max. depth and bottom time, e. g., 100'/25
- Single dive: Any dive conducted more than 12 hours after a previous dive
- Surface Interval Time (SIT): Time spent at the surface between dives.
- Residual nitrogen: Amount of nitrogen gas remaining in a diver's tissues following a dive
- Repetitive dive: Any dive conducted less than 12 hours after a previous dive.



Table Definitions-3

- Repetitive Group Designation (RGD): A letter that designates the amount of nitrogen remaining in a diver's body during a 12-hour period following a dive
- Residual Nitrogen Time (RNT): Time (minutes) that must be considered when calculating the bottom time of a repetitive dive to compensate for nitrogen remaining in a diver's tissues from a previous dive.
- Equivalent Single Dive Time (ESDT): Time (minutes) used to select a schedule for a single repetitive dive. Equal to the bottom time of the planned repetitive dive plus the diver's residual nitrogen time (ABT + RNT)



Dive Table Rules

- All dive schedules not specifically listed are covered in the tables by the next deeper and longer schedule
- Enter tables at the listed depth that is exactly equal to, or is the next greater depth than the maximum depth attained during a dive
- Select the bottom time that is exactly equal to, or is next greater than the bottom time of the dive
- The rate of ascent from the bottom to the surface and between decompression stops is 30 fpm



USN No-Deco Tables-1

- The U. S. Navy No-Decompression Limits and Repetitive Group Designation Table
- Summarizes all depth and bottom time combinations that do not require staged decompression
- Provides repetitive group designation (RGD) for each no-decompression dive

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
10		60	120	210	300	797	*
15		35	70	110	160	225	350
20		25	50	75	100	135	180
25	595	20	35	55	75	100	125
30	405	15	30	45	60	75	95
35	310	5	15	25	40	50	60



USN No-Deco Tables-3

- Description:
 - First vertical column on far left lists various depths from 10 to 190 fsw
 - Second vertical column from the left lists depths from 3 to 59.9 meters
 - Third vertical column from the left indicates the maximum No-decompression Limits in minutes for each depth
 - Remaining vertical columns list specific bottom times ranging from 5 minutes To 917 minutes
 - Horizontal top row lists the repetitive group designation from A to O



USN No-Deco Tables-4

- Description, cont.

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
10		60	120	210	300	797	*									
15		35	70	110	160	225	350	452	*							
20		25	50	75	100	135	180	240	325	390	917	*				
25	595	20	35	55	75	100	125	160	195	245	315	361	540	595		
30	405	15	30	45	60	75	95	120	145	170	205	250	310	344	405	
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310

- Depths shallower than 20 feet do not have a specific no-decompression limit. The USN determined that times listed were sufficient for any operational tasks required
- Dives with times that exceed those listed on the table must use the USN Standard Air Table



USN No-Deco Tables-5

- Application:
 - Locate exact or next greater depth from vertical column on far left
 - Move horizontally to locate exact or next greater bottom time
 - Move vertically to the top of the page and read the repetitive group designation (RGD) letter

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
10		60	120	210	300	797	*
15		35	70	110	160	225	350
20		25	50	75	100	135	180
25	595	20	35	55	75	100	125
30	405	15	30	45	60	75	95
35	310	5	15	25	40	50	60
40	200	5	15	25	30	40	50
50	100		10	15	25	30	40
60	60		10	15	20	25	30



USN No-Deco Tables-6

- Questions 1 and 2:
 - What is the max. no-decompression limit for a dive to 60 feet?
 - What is the RGD for the 60':60 dive?

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>
10		60	120	210	300	797	*					
15		35	70	110	160	225	350	452	*			
20		25	50	75	100	135	180	240	325	390	917	*
25	595	20	35	55	75	100	125	160	195	245	315	361
30	405	15	30	45	60	75	95	120	145	170	205	250
35	310	5	15	25	40	50	60	80	100	120	140	160
40	200	5	15	25	30	40	50	70	80	100	110	130
50	100		10	15	25	30	40	50	60	70	80	90
60	60		10	15	20	25	30	40	50	55	60	



USN No-Deco Tables-7

- Answers to questions 1 and 2:

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>
10		60	120	210	300	797	*					
15		35	70	110	160	225	350	452	*			
20		25	50	75	100	135	180	240	325	390	917	*
25	595	20	35	55	75	100	125	160	195	245	315	361
30	405	15	30	45	60	75	95	120	145	170	205	250
35	310	5	15	25	40	50	60	80	100	120	140	160
40	200	5	15	25	30	40	50	70	80	100	110	130
50	100		10	15	25	30	40	50	60	70	80	90
60	60		10	15	20	25	30	40	50	55	60	

Question #1: 60 minutes

Question #2: RGD = J



USN No-Deco Tables-8

- Question #3:
 - What is the maximum no-decompression limit for a dive to 33 feet?

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
10		60	120	210	300	797	*									
15		35	70	110	160	225	350	452	*							
20		25	50	75	100	135	180	240	325	390	917	*				
25	595	20	35	55	75	100	125	160	195	245	315	361	540	595		
30	405	15	30	45	60	75	95	120	145	170	205	250	310	344	405	
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310
40	200	5	15	25	30	40	50	70	80	100	110	130	150	170	200	



USN No-Deco Tables-9

- Answer to question #3:

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
10																
15																
20																
25																
30																
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	
40																

- The maximum no-decompression limit for a dive to 33 fsw is 310 minutes.



USN No-Deco Tables-11

- Answer to question #4:

<i>FSW</i>	<i>MAX</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
100	25		5	7	10	15	20	22	25							
110	20			5	10	13	15	20								
120	15			5	10	12	15									
130	10			5	8	10										

- The RGD for a dive to 115 fsw for 14 minutes is F



USN Repetitive Dive Tables-1

- Residual nitrogen timetable for repetitive air dive
 - Surface Interval Table
 - Residual Nitrogen Table
- Purpose: To provide a means to determine the amount of nitrogen remaining in a diver's body when planning a repetitive dive





USN Repetitive Dive Tables-2

- Surface Interval Credit Table

- Credits time that a diver at the surface off-gasses nitrogen
- Minimum SIT must be 10 minutes
- A dive started less than 10 minutes after a previous dive is considered part of the same dive

- Dives 12 hours or more after a previous dive are not repetitive dives and do not require RNT calculation

				A	0:10 12:00
			B	0:10 3:20	3:21 12:00
		C	0:10 1:39	1:40 4:49	4:50 12:00
	D	0:10 1:09	1:10 2:38	2:39 5:48	5:49 12:00
	E	0:10 0:54	0:55 1:57	1:58 3:24	3:25 6:34
F	0:10 0:45	0:46 1:29	1:30 2:28	2:29 3:57	3:58 7:05
	F	E	D	C	B
					A



USN Repetitive Dive Tables-4

Application--SIT:

- Enter the schedule on the diagonal slope using the RGD from the previous dive
- Read horizontally until the surface interval is equal to, or between, the times shown in the schedule
- Read the new RGD at the bottom of the column

				A	0:10 12:00	
			B	0:10 3:20	3:21 12:00	
		C	0:10 1:39	1:40 4:49	4:50 12:00	
	D	0:10 1:09	1:10 2:38	2:39 5:48	5:49 12:00	
	E	0:10 0:54	0:55 1:57	1:58 3:24	3:25 6:34	6:35 12:00
F	0:10 0:45	0:46 1:29	1:30 2:28	2:29 3:57	3:58 7:05	7:06 12:00
	F	E	D	C	B	A

IN →

↓ OUT



USN Repetitive Dive Tables-5

- Residual Nitrogen Timetable
 - Used to determine the amount of nitrogen (RNT) that must be considered for repetitive dives
 - RNT is considered time that the diver has already spent at depth for the planned repetitive dive
 - When the SIT is less than 10 minutes, the RNT for a repetitive dive is the same as the ABT from the previous dive

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	797	279	159	88	39
20	**	**	**	**	**	**	917	399	279	208	159	120	88	62	39	18
30	†	†	†	349	279	229	190	159	132	109	88	70	54	39	25	12
40	257	241	213	187	161	138	116	101	87	73	61	49	37	25	17	7
50	169	160	142	124	111	99	87	76	66	56	47	38	29	21	13	6



USN Repetitive Dive Tables-6

- Description--Residual Nitrogen Timetable:
 - Far left column lists depth of the repetitive dive from 10 to 190 fsw
 - 16 columns of residual nitrogen times for specific depths

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	797	279	159	88	39
20	**	**	**	**	**	**	917	399	279	208	159	120	88	62	39	18
30	†	†	†	349	279	229	190	159	132	109	88	70	54	39	25	12
40	257	241	213	187	161	138	116	101	87	73	61	49	37	25	17	7
50	169	160	142	124	111	99	87	76	66	56	47	38	29	21	13	6
60	122	117	107	97	88	79	70	61	52	44	36	30	24	17	11	5
70	100	96	87	80	72	64	57	50	43	37	31	26	20	15	9	4



USN Repetitive Dive Tables-7

- Application--RNT:
 - Enter the timetable vertically with the RGD from the SIT table
 - Read directly the bottom time to be added to the repetitive dive in the depth row for the dive

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	797	279	159	88	39
20	**	**	**	**	**	**	917	399	279	208	159	120	88	62	39	18
30	†	†	†	349	279	229	190	159	132	109	88	70	54	39	25	12
40	257	241	213	187	161	138	116	101	87	73	61	49	37	25	17	7
50	169	160	142	124	111	99	87	76	66	56	47	38	29	21	13	6
60	122	117	107	97	88	79	70	61	52	44	36	30	24	17	11	5
70	100	96	87	80	72	64	57	50	43	37	31	26	20	15	9	4
80	84	80	73	68	61	54	48	43	38	32	28	23	18	13	8	4



USN Repetitive Dive Tables-8

- Question #1:
 - What is the Residual Nitrogen Time (RNT) for a Group G diver planning a repetitive dive to 75 fsw after a Surface Interval (SIT) of 2½ hours?



USN Repetitive Dive Tables-9

- Answer to question #1:
– RNT = 18 mins.

				E	0:10 0:54	0:55 1:57	1:58 3:24	3:25 6:34
			F	0:10 0:45	0:46 1:29	1:30 2:28	2:29 3:57	3:58 7:05
		G	0:10 0:40	0:41 1:15	1:16 1:59	2:00 2:58	2:59 4:25	4:26 7:35
	H	0:10 0:36	0:37 1:06	1:07 1:41	1:42 2:23	2:24 3:20	3:21 4:49	4:50 7:59
I	0:10 0:33	0:34 0:59	1:00 1:29	1:30 2:02	2:03 2:44	2:45 3:43	3:44 5:12	5:13 8:21
						D	C	B
60	61	52	44	36	30	24	17	11
70	50	43	37	31	26	20	15	9
80	43	38	32	28	23	18	13	8
90	38	33	29	24	20	16	11	7



USN Repetitive Dive Tables-10

- Question #2:
 - What is the RNT for a Group C diver planning a repetitive dive to 65 fsw after an SIT of 1 hour and :05 minutes?



USN Repetitive Dive Tables-11

- Answer to question #2:
– RNT = 15 mins.

				A	0:10 12:00
			B	0:10 3:20	3:21 12:00
		C	0:10 1:39	1:40 4:49	4:50 12:00
	D	0:10 1:09	1:10 2:38	2:39 5:48	5:49 12:00
E	0:10 0:54	0:55 1:57	1:58 3:24	3:25 6:34	6:35 12:00
	E	D	C	B	A
50	38	29	21	13	6
60	30	24	17	11	5
70	26	20	15	9	4
80	23	18	13	8	4



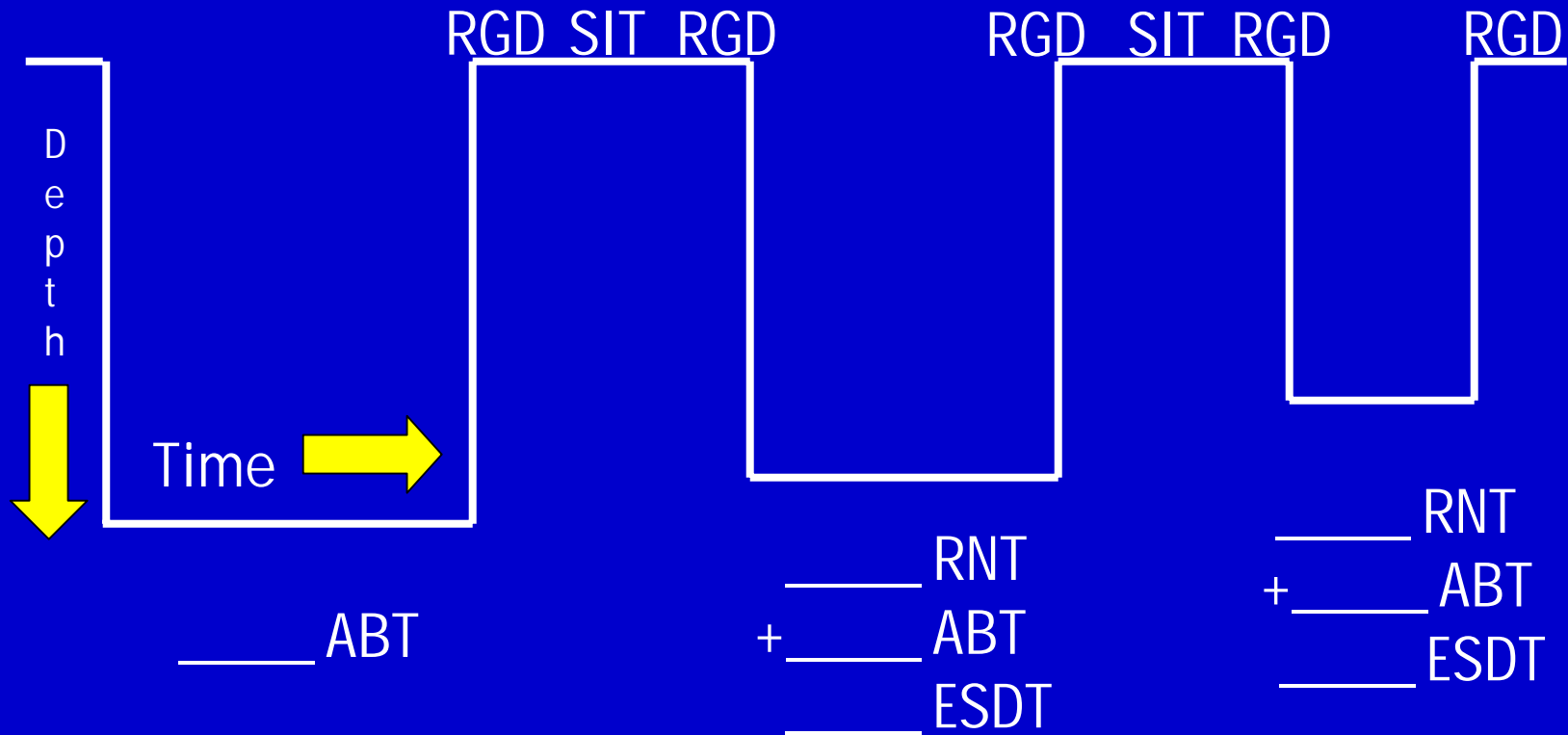
USN Repetitive Dive Tables-12

- Question #3:
 - A diver makes a dive to 95 fsw for 20 minutes. After a surface interval of 2½ hours, the diver wants to make a second dive to 90 fsw. What's the maximum no-decompression time allowed on the second dive?



Diagramming Dives

- Depth = Vertical axis Time = Horizontal axis





USN Repetitive Dive Tables-13

- Answer to question #3: Maximum of 19 minutes

	F 2:30	C	H
95'	100'/:20	90'	90'/:30
	20 ABT		
		11 RNT	
		<u>19 ABT</u>	
		30 ESDT	



Key Points

- Know the dive table terms and abbreviations
- Always follow the dive table rules--DO NOT INTERPOLATE
- Learn when to use which dive table
- Always diagram dives
- Ascend no faster than 30 fpm
- Good table use requires frequent practice