Unit 5:
Dive Tables and Dive Computers

- **Dive Tables**
- **Equivalent Air Depth and Standard Air Tables**
- **Using NAUI's RGBM Tables**
- **The Rule of Halves**
- **Dive Computers**

Student Performance:

By the end of the lesson you will be able to:

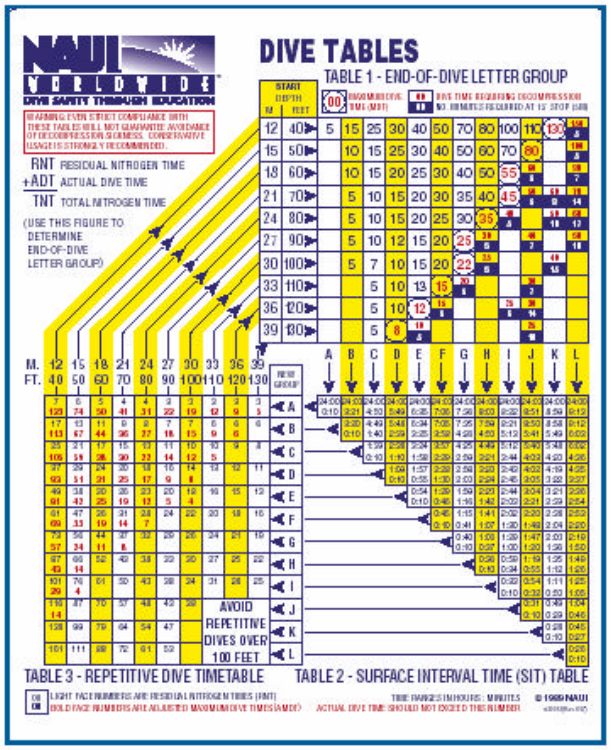
- **Demonstrate the use of NAUI EAN_X Dive Tables.**
- **Define Equivalent Air Depth and how it is used with Air Dive Tables.**
- **Demonstrate how to determine and calculate Equivalent Air Depth.**
- **Demonstrate the use of the NAUI RGBM Nitrox Dive Tables.**
- **State the "Rule of Halves" and how to use it in all of your diving.**
- **Describe the procedures for using dive computers for EAN_X diving.**

Dive Tables

- There are many different dive tables in use today
  - NAUI Dive Tables
  - NAUI RGBM Tables
  - U.S. Navy Tables
  - DCIEM Tables
  - Buhlmann based tables
  - Other Tables

Air Dive Tables

- **So-called “standard dive tables” are designed for diving while breathing air.**



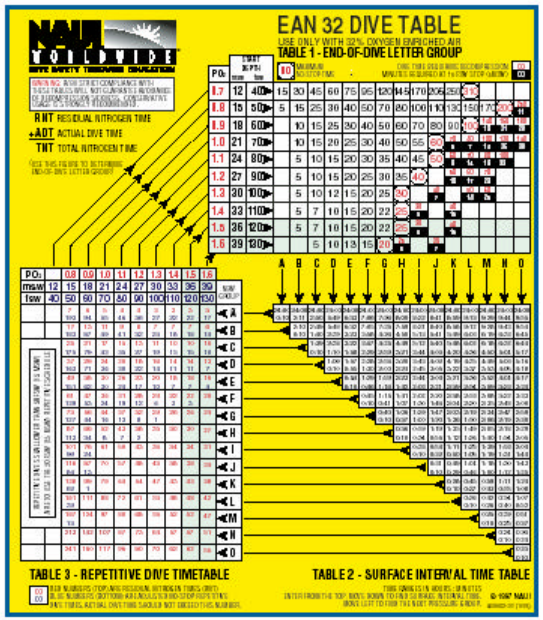
No-required Stop Times

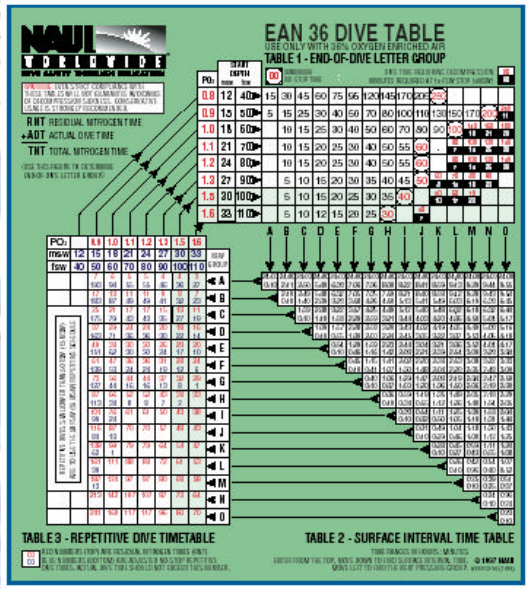
- **EANx Dive Tables give increased maximum dive times for standard mixes.**

No-Required-Stop Dive Times for Single Dives									
Depth fsw	Depth msw	U.S. Navy Air Table	NAUI Air Table	NAUI RGBM Air Table	NAUI/NOAA EAN_{32} Table	NAUI RGBM EAN_{32} Table	NOAA EAN_{36} Table	NAUI EAN_{36} Table	NAUI RGBM EAN_{36} Table
30	9	310	130	150	310	150	unlimited	250	150
40	12	200	130	110	310	150	405	250	150
50	15	100	80	80	200	115	310	200	150
60	18	60	55	55	100	85	100	100	115
70	21	50	45	40	60	60	100	60	85
80	24	40	35	30	50	47	60	60	60
90	27	30	25	25	40	38	50	60	46
100	30	25	22	20	30	30	40	40	35
110	33	20	15	16	25	25	30	30	31
120	36	15	12	13	25	20	$PO_2 > 1.6$	$PO_2 > 1.6$	$PO_2 > 1.6$
130	40	10	8	10	12	N/A	$PO_2 > 1.6$	$PO_2 > 1.6$	$PO_2 > 1.6$

Enriched Air Nitrox Dive Tables

- Enriched Air Nitrox Tables



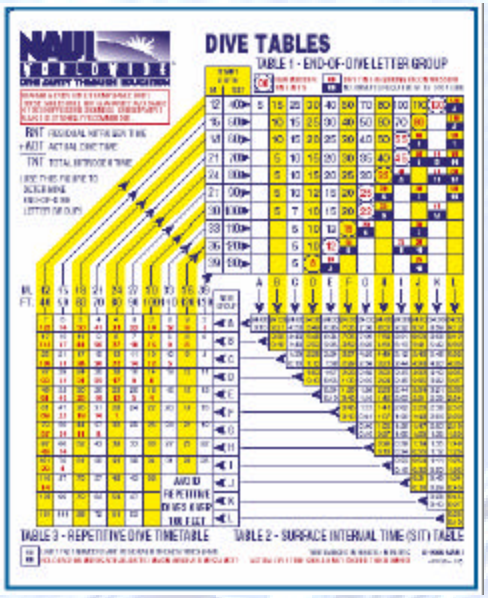


Enriched Air Nitrox Dive Tables continued

- **NAUI EAN Dive Table Rules**
  - Treat each dive as a square profile dive, with the deepest point reached on the dive being used as the depth for the whole dive.
  - If the exact depth or time does not appear on the table, round up to the next greater number.
  - The tables assume an ascent rate of 30 feet/9 meters per minute.
  - Planning repetitive dives progressively shallower will yield shorter required surface interval times.
  - The required surface interval between two separate dives is 10 minutes; the minimum recommended surface interval is one hour.
  - The tables are designed to be used at sea-level atmospheric pressure, and adjustments must be made for altitudes above about 1000 feet/300 meters.
  - If flying or ascending to altitude after diving, wait 12 hours after a single dive and 18 hours after a repetitive dive series.

Equivalent Air Depth and Standard Air Tables

- **Equivalent Air Depth is determined by the partial pressure of nitrogen that the diver is actually breathing**
  - **Because nitrox has a lower fraction of nitrogen than air, the nitrogen partial pressure will also be less than with air for any given depth, and the diver's equivalent depth for nitrogen absorption will also be less than with air.**
  - **It is not the actual depth, but the partial pressure of nitrogen in the breathing gas that matters.**



Equivalent Air Depth and Standard Air Tables continued

- **EAD Example:**
  - **If you were breathing a mixture that is 36% oxygen, then the nitrogen percentage would be 64%, and the nitrogen fraction would be 0.64.**
  - **When you dive with this mixture, you expose yourself to 64/79ths the nitrogen partial pressure that you would encounter if breathing air.**
  - **Therefore, you can consider your depth to be 64/79ths (roughly 80%) of the absolute pressure that you would encounter at your actual depth if you were breathing air.**

Equivalent Air Depth and Standard Air Tables continued

- **Equivalent Air Depth by Table (imperial)**

Equivalent Air Depth (in fsw)															
Percent O_2	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%	36%	37%	38%	39%	40%
EAD fsw															
40	44	46	47	48	49	50	51	53	54	55	57	58	60	61	63
50	55	56	58	59	60	62	63	64	66	67	69	71	72	74	76
60	66	67	69	70	71	73	75	76	78	80	81	83	85	87	89
70	76	78	80	81	83	84	86	88	90	92	94	96	98	100	99
80	87	89	90	92	94	96	98	100	102	104	106	108	105	102	
90	98	100	101	103	105	107	109	112	114	116	113	109			
100	108	110	112	114	117	119	121	123	122	117					
110	119	121	123	126	128	130	132	127							
120	130	132	134	137	139	137									
130	141	143	145	148	143										
MOD/1.4 ata	145	138	132	126	121	116	111	107	102	99	95	91	88	85	82
MOD/1.6 ata	170	162	155	149	143	137	132	127	122	117	113	109	105	102	99

Equivalent Air Depth and Standard Air Tables continued

- **Equivalent Air Depth by Table (metric)**

Equivalent Air Depth (in msw)															
Percent O_2	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%	36%	37%	38%	39%	40%
EAD msw															
12	13	13	14	14	14	15	15	16	16	16	17	17	18	18	19
15	16	17	17	17	18	18	19	19	20	20	20	21	21	22	22
18	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26
21	23	23	24	24	25	25	26	26	27	27	28	28	29	30	30
24	26	26	27	27	28	28	29	30	30	31	32	32			
27	29	30	30	31	31	32	33	33	34	35					
30	32	33	33	34	35	35	36	37	37						
33	36	36	37	37	38	39	39	40							
36	39	39	40	41	41										
40	43	44	44	45											
MOD/1.4 ata	43	41	40	38	36	35	33	36	31	30	28	27	26	25	25
MOD/1.6 ata	51	49	47	45	43	41	40	38	37	35	34	33	32	31	30

Equivalent Air Depth and Standard Air Tables continued

- **Calculating Equivalent Air Depth**
  - **Equivalent air depth can be calculated in discrete steps, or the procedure can be combined into a single formula.**
  - **Step 1: Determine the absolute pressure at the depth to which you will be diving.**
  - **Step 2: Apply the nitrogen "credit" that your nitrox blend gives you.**
  - **Step 3: Convert this air-equivalent absolute pressure to an equivalent air depth**

Equivalent Air Depth and Standard Air Tables continued

- **Step 1:**
- **P ata = (D fsw / 33 fsw/atm) + 1 atm**
- **Step 2:**
- **$P\ ata_{EAD} = (F_{in\ mix} / F_{in\ air}) \times P\ ata$**
- **Step 3:**
- **$EAD\ fsw = (P\ ata_{EAD} - 1\ atm) \times 33\ fsw/atm$**

Equivalent Air Depth and Standard Air Tables continued

- **Calculating EAD**
  - **Example: What is the equivalent air depth for a diver diving with EAN_{32} to a depth of 80 feet/24 meters?**

Step 1: Find the absolute pressure at 80 fsw using the formula from Chapter 2: or = 3.42 ata

Equivalent Air Depth and Standard Air Tables continued

- **Calculating EAD**
  - Step 2: Apply your nitrogen "credit." Since you are diving with EAN_{32}, the nitrogen fraction of your mix is 0.68 (= 1.0 - 0.32). Your air-equivalent absolute pressure is set by the ratio between the fraction of nitrogen in your mix and the fraction of nitrogen in air, or:

P ata (air equiv) = (0.68/0.79) x 3.42 ata = 2.94 ata

Equivalent Air Depth and Standard Air Tables continued

- **Calculating EAD**
  - **Step 3: Convert 2.94 ata to an equivalent air depth:**
  - **D fsw = (P ata – 1 atm) x 33 fsw / atm**
  - **D fsw = (2.94 ata – 1 atm) x 33 fsw / atm = 64 fsw**
  - **You would use for 70 feet / 21 meters on your dive tables.**

Equivalent Air Depth and Standard Air Tables continued

- **Calculating EAD using a single formula**

$$EAD\ \ fsw = \left(\frac{(D\ fsw + 33\ fsw)\ x\ FN_2}{0.79} \right) - 33\ fsw$$

$$EAD\ fsw = \left(\frac{(D\ fsw + 33\ fsw) + (1 - FO_2)}{0.79} \right) - 33\ fsw$$

Equivalent Air Depth and Standard Air Tables continued

- **Calculating EAD with the OCEANx**
  - **To find equivalent air depth with the OCEANx calculator, dial-in the oxygen percentage into the upper window. The long window immediately below shows the maximum actual depth to be used with each equivalent air depth, which is printed immediately to the right.**

Using NAUI's RGBM Tables

- **NAUI RGBM Dive Tables are "No-Calculation" tables and do not require use of letter groups, a surface interval credit table, or residual nitrogen times, thus making repetitive dive planning extremely easy and straightforward.**
- **NAUI RGBM Dive Tables have been prepared for EAN_{32} and EAN_{36} as well as for air diving. The sea-level tables provide dive-planning information for altitudes up to 2000 feet/610 meters.**
- **Additional sets of tables are available for diving at altitudes between 2000 and 6000 feet/610 to 1829 meters and for 6000 and 10,000 feet/1829 to 3048 meters.**


NAUI WORLDWIDE
DIVE SAFETY THROUGH EDUCATION

Reduced Gradient Bubble Model (RGBM)

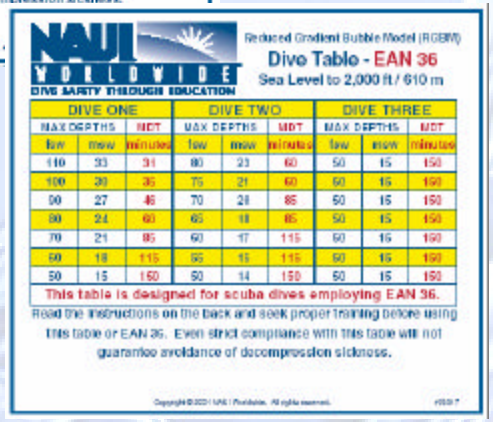
Dive Table - EAN 32

Sea Level to 2,000 ft / 610 m

DIVE ONE			DIVE TWO			DIVE THREE		
MAX DEPTHS		MDT	MAX DEPTHS		MDT	MAX DEPTHS		MDT
feet	meters	minutes	feet	meters	minutes	feet	meters	minutes
120	36	20	80	24	47	40	12	150
110	33	25	75	23	47	40	12	150
100	30	30	70	21	60	40	12	150
90	27	38	65	20	60	40	12	150
80	24	47	60	18	85	40	12	150
70	21	60	55	17	85	40	12	150
60	18	85	50	15	115	40	12	150
50	15	115	45	14	115	40	12	150
40	12	150	30	12	150	30	12	150

This table is designed for scuba dives employing EAN 32.

Read the instructions on the back and seek proper training before using this table or EAN 32. Even strict compliance with this table will not guarantee avoidance of decompression sickness.


NAUI WORLDWIDE
DIVE SAFETY THROUGH EDUCATION

Reduced Gradient Bubble Model (RGBM)

Dive Table - EAN 36

Sea Level to 2,000 ft / 610 m

DIVE ONE			DIVE TWO			DIVE THREE		
MAX DEPTHS		MDT	MAX DEPTHS		MDT	MAX DEPTHS		MDT
feet	meters	minutes	feet	meters	minutes	feet	meters	minutes
110	33	31	80	23	60	50	15	150
100	30	35	75	21	60	50	15	150
90	27	45	70	20	85	50	15	150
80	24	60	65	18	85	50	15	150
70	21	85	60	17	115	50	15	150
60	18	115	55	15	115	50	15	150
50	15	150	50	14	150	50	15	150

This table is designed for scuba dives employing EAN 36.

Read the instructions on the back and seek proper training before using this table or EAN 36. Even strict compliance with this table will not guarantee avoidance of decompression sickness.

Using NAUI's RGBM Tables

continued

- The important RGBM table rules are:
  - A minimum surface interval of one hour is required between each dive.
  - If the actual dive depth is not listed, round up to the next greater depth.
  - The depth of each repetitive dive must be no greater than the depth shown on the row immediately to the right of the previous dive's depth; of course, it may be shallower than this maximum repetitive-dive depth.

Using NAUI's RGBM Tables

continued

- **The important RGBM table rules are:**
  - **As the tables are designed, there can be no shallow dive followed by a deeper dive.**
  - **The maximum ascent rate is 30 feet/9 meters per minute.**
  - **All dives require a 3-minute safety stop at 15 feet (± 3 feet)/5 meters (± 1 meter)**

Using NAUI's RGBM Tables

continued

- **The important RGBM table rules are:**
  - **On the sea level to 2,000 feet tables, no more than three repetitive dives within a 12-hour period. In actual practice, the "third dive" may be a series of repetitive dives not exceeding the total maximum dive time of 150 minutes.**
  - **The flying after diving rule is to wait at least 12 hours after a single dive within the prior 18-hour period, 15 hours after two dives, and 18 hours after three dives.**

Using NAUI's RGBM Tables

continued

- **Dive example (using EAN32)**
  - **Dive 1: 24 m/80 feet for 47 minutes**
  - **1hour Surface Interval**
  - **Dive 2: 18 m/60 feet for 85 minutes**
  - **1 hr Surface Interval**
  - **Dive 3: 12 m/40 feet for up 150 minutes**

Using NAUI's RGBM Tables

continued

- **When using the NAUI RGBM Tables, you may also switch tables from leaner to richer oxygen fractions from dive one to dive two (or dive two to dive three) by simply following the maximum depth constraints as you move between the appropriate dive tables.**
- **For example, it is possible to use air and the NAUI RGBM Air Table on Dive One, then switch to EAN_{36} and use the RGBM EAN_{36} Table on Dive Two.**

Rule of Halves

- When ending any no-decompression dive in excess of 12 meters / 40 feet, halve the distance from the dive's deepest depth to the surface. Ascend to that depth and make a one-minute safety stop. Then continue your ascent to the 5 meter/15 foot safety stop and complete the last two minutes of your three-minute safety stop at 5 meters/15 feet.

Dive Computers and Nitrox

- Dive computers perform real time dive calculations.
- Generally, their algorithms are quite conservative.
- Because they sample the diver's depth and dive time every few seconds and recalculate nitrogen absorption over a range of theoretical tissue compartments, divers enjoy extended dive times when using a dive computer.
- In effect, the diver receives "credit" for the shallow portions of the dive, which is not possible with the "square-profile" assumptions of dive tables.

Dive Computers and Nitrox

continued

- **Two basic options**
  - **Use a Nitrox capable computer**
  - **Use an Air capable computer to increase your safety margins.**

Note: Currently, many manufacturers have incorporated the NAUI RGBM algorithms as well as the NAUI Rule of Halves into their dive computers.

End of Unit 5

Dive Tables and Dive Computers

- Dive Tables
- Equivalent Air Depth and Standard Air Tables
- Using NAUI's RGBM Tables
- The Rule of Halves
- Dive Computers

Student Performance:

By the end of the lesson you will be able to:

- **Demonstrate the use of NAUI EANx Dive Tables.**
- **Define Equivalent Air Depth and how it is used with Air Dive Tables.**
- **Demonstrate how to determine and calculate Equivalent Air Depth.**
- **Demonstrate the use of the NAUI RGBM Nitrox Dive Tables.**
- **State the "Rule of Halves" and how to use it in all of your diving.**
- **Describe the procedures for using dive computers for EAN_x diving.**