

V H

% O<sub>2</sub> in all formulas must be converted to hundredths

1      66    - 33 = Cutoff Depth      2                      = Maximum O<sub>2</sub>

3. Distance Traveled x 60 = Time between stops in seconds  
FPM

4  $\frac{(D + 33) \times O_2}{33} = \text{Effective Atmosphere}$       5.  $PP = (D + 33) (1.00 - (O_2 - .02))$

- 1
  - A. Name and Rate on Chart.
  - B. Depth of dive.
  - C. Oxygen Percent being used.
  - D. Time left surface.
  - E. Bottom Time.
  - F. Type of chart either Formulation or Tabulation.
  - G. Figure Maximum O<sub>2</sub> 66  
D + 33
  - H. Figure effective atmospheres:  $\frac{(D + 33) \times O_2}{33}$
  - I. Figure pressure in pounds.
- 2
  - A. Obtain table by Formulation or Tabulation.
  - B. Place on Chart (Formulate  $PP = (D + 33) (1.00 - (O_2 - .02))$ )
  - C. Turn to PPT Pamphlet or Diving Manual.
  - D. Place time to first stop on chart.
  - E. Check for asterisk (if there is one, add extra minute to second stop).
  - F. Place all decompression stops on chart (Note: 50 ft. stop shift to O<sub>2</sub> and write on chart, - 40 ft. stop on O<sub>2</sub>).
  - G. At the 40 ft. stop subtract one minute, use that one minute to come from 40 ft. to surface. (Example: 20 min. stop 20-1 = 19 min.),
- 3.
  - A. Turn to rate of ascent table.
  - B. Draw rate of ascent line, descent line, and ascent line on chart.
  - C. Place rate of ascent on chart.
  - D. Place arrow where appropriate on chart.
- 4
  - A. Figure time for descent 65 FPM.

(e) Repetitive diving is not allowed in a twelve-hour period.

The helium-oxygen decompression tables comprise:

- (a) Partial Pressure Table 1-12
- (b) Helium-Oxygen Decompression Table 1-13
- (c) Rate of Ascent 1-14
- (d) Emergency Table HeO<sub>2</sub> Table 1-15
- (e) Emergency Table (Air) Table 1-16

#### OXYGEN LIMITS IN HELIUM-OXYGEN DIVING

For exposure times up to 30 minutes, 2.0 atmospheres is the maximum safe oxygen partial pressure (see arts. 1.3.11 and 1.5.7). The maximum allowable oxygen percentage for a gas mixture used in a dive of 30 minutes or less may be determined from the following formula:

(where D equals depth):

?

x 33

Maximum Oxygen percentage =  $(D +$

*(we use 1.2*

As exposure time increases, the maximum safe oxygen partial pressure decreases. (See 1.5.7 (8)). Therefore, in dives longer than 30 minutes bottom time, substitute the maximum oxygen partial pressure from Table 1-11 for 2.0 in the formula given (and in art. 2.6.3 (21)).

Example:

1.  $2.0 \text{ Atmos.} \times 33 = \text{Maximum O}_2$   
 $297 + 33$

2.  $\frac{6600}{330} = \text{Max. O}_2$

3.  $330 \overline{)6600}^{.20\%}$   
660  
0000

## PARTIAL PRESSURE TABLE

1. The use of partial pressure of inert gas instead of actual depth of dive is the main difference between the air and helium-oxygen decompression methods. This table provides the partial pressure of inert gas.

2. The table is based on the formula:

$$PP(AOG) = (D+33) \times [1.00 - (O_2 - 0.02)]$$

Where PP(AOG) = Partial pressure in feet of all other gases except oxygen.

D = Actual gage depth of water in feet

O<sub>2</sub> = Decimal equivalent of oxygen percentage

0.02 = An assumed loss of 2 percent of oxygen in the helmet

Example:

297 ft. 20% O<sub>2</sub>

$$\begin{aligned} PP &= (297+33) \times [1.00 - (O_2 - 0.02)] \\ &= 330 \times [1.00 - 0.18] \\ &= 330 \times .82 \\ &= 270.6 \end{aligned}$$

3. Enter the table with the actual depth on the left side of the table. Follow across to the column headed by the average percentage oxygen of the bank in use. The partial pressure is the value tabulated at this point.

## HELIUM-OXYGEN DECOMPRESSION TABLE

1. Decompression schedules are given for each 10 feet of partial pressure from 60 to 410 and for bottom times of 10 to 240 minutes in increments of about 10 minutes.
2. The evaluation made to date on the schedules with longer exposure has been inadequate. There is some doubt as to their value. When priorities permit, complete evaluations will be made and necessary corrections issued.
3. Details on the use of the Helium-Oxygen Decompression Table are:

(a) To obtain the decompression schedule, use the partial pressure group that is exactly equal to or is next greater than that you computed. Use the bottom time that is exactly equal to or is next longer than the actual bottom time of the dive. Do not interpolate.

Example: Assume the bottom time of the 297 foot dive above was 19 minutes. The partial pressure was 270.6, so the proper decompression schedule is a partial pressure of 280 and a bottom time of 20.

(b) Obtain the rate of ascent to the first stop by dividing the distance in feet from the bottom to the first stop by the number of minutes listed in the "To The First Stop" column of the proper decompression schedule.

Example: Use the dive and decompression schedule above. The distance to the first stop is  $297 - 120 = 177$  feet. The "4" listed in the "To The First Stop" column means that you are to take 4 minutes in ascent. Divide 177 by 4 and obtain a rate of ascent of about 44 feet per minute.

(c) Remain at the first stop for the number of minutes specified (usually 7).

(d) Obtain the rate of ascent between subsequent stops as instructed on the following page under use of the Rate of Ascent Table.

SAMPLE OF HOW TO COMPLETE RATE OF ASCENT TABLE

Depth	% <sup>0</sup> 2	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
200		10	16	22	28	34	40	42	44	46	48						FPM--
150		10	14	18	22	26	30	32	34	36	38						48 50
100		10	12	14	16	18	20	22	24	26	28						38 40
50		10	10	10	10	10	10	12	14	16	18						20 20

Seconds Between Stops

Distance Between Stops x 60 Seconds = Seconds  
 Feet Per Minute

Example: 20 Feet x 60 Seconds = Seconds  
 30 FPM

$$\frac{1200}{30} = 40 \text{ Seconds Between St}$$

2. The depth of the stop and the supply of the variable factors. Interpolate between the list but use the rates for listed depths without interpolate the 297 foot/29 minute dive, 20% O<sub>2</sub>. Determine the first stop to the second as follows:

ntage are centages, ple: Use cent from

From	Distance	Rate of Ascent
Ft.	Ft.	Ft/Min
120-100	20	40
100-90	10	30
Sum	-----	-----

EMERGENCY TABLE (He<sup>0</sup>2)

1. In an emergency it may happen that on for decompression due to failure of the oxygen supply of oxygen poisoning. Either air or helium-oxygen used. The procedure for use of helium-oxygen is in Table 1-15 on the following page.

e used nptoms 1st be available

2. The decompression can be calculated for each case. However, since the emergency may occur at any point from the bottom to the last stop, it is impractical to attempt to cover all of the possibilities in tables.

3. The table is simple. Schedules are provided for each 50 feet. Select the one next deeper than the actual depth unless it is exactly at an even 50-foot figure.

4. In the event of an emergency when diving with HeO<sub>2</sub>, the rate of ascent to the first stop on emergency tables should comply with the rate of ascent to first stop as listed in PP Tables, but not normally exceed sixty feet per minute. The rate of ascent on subsequent stops using Emergency Air Table is not critical as long as the full decompression is received at each stop.

#### OXYGEN FOLLOWING A HELIUM-OXYGEN DIVE

1. Recompression chambers equipped with oxygen are available at any helium-oxygen diving operation. Surface decompression may be used as a routine procedure, as described in the following paragraphs:

2. In tables where the first stop is 40 feet, bring the diver to 40 feet, shift to oxygen, and stay 10 minutes. Surface the diver in 1 minute and return him to 40 feet in the recompression chamber on oxygen for the full time of the 40-foot stop. Not more than 5 minutes should elapse from the time of leaving the water stop to reaching the chamber stop. During the last 5 minutes of decompression time, surface the diver at a uniform rate.

#### Example

Partial Pressure	100
Time of dive (minutes)	40
Time (minutes)	
Leave Bottom	0
Reach 40 feet	3
Ventilate 25 cu. ft. of oxygen	
Leave 40	13
Reach Surface	14
Leave Surface	16
Reach 40	16 1/2
Leave 40	42 1/2
Reach Surface	47 1/2

helium-oxygen and the diver ordered to ventilate.

Prompt reporting of symptoms and fast shifting from oxygen frequently will relieve the symptoms before the diver becomes unconscious.

If symptoms occur during the chamber stop, remove the oxygen mask.

In either case, the remainder of the decompression is carried out by following the Emergency Helium-Oxygen Table or Emergency Air.

10. While breathing oxygen, remain as quiet as possible. Under no circumstances should the diver attempt to clear stagelines or work while on oxygen stops.

11. In the recompression chamber, the mask must be leakproof and snugly fitted to insure the breathing of pure oxygen. At 40 feet, the average diver will use between 5 to 6 pounds of oxygen per minute from one cylinder.

12. During surface decompression, a tender should always be in the recompression chamber when the diver is on oxygen.

13. With over 400 feet of airhose rigged, use 100 pounds excess pressure for ventilating at the first oxygen stop. Drop the pressure to 50 pounds excess when the diver goes on closed circuit.

14. Experience aboard the ASR Vessels of the Atlantic Fleet during the past two years has shown that fathometers, leadlines, and descending lines or stagelines cannot be used to determine the depth with accuracy. A simple and accurate method to determine depth is by means of a Pneumofathometer with a depth gauge calibrated in feet of sea water. The Pneumofathometer is connected to an air supply and an oxygen hose. The oxygen hose is made up with the diver's lifeline and air hose, the open end terminating at about breastplate level. To take a reading, blow air through the hose until it escapes at the open end, then secure the air supply. The pressure remaining in the oxygen hose is that necessary to balance a column of water corresponding to the depth of the open end of the hose and is read directly on the gauge in feet. While the diver is standing, add 5 feet to determine bottom depth. This device is especially valuable during the ascent when the diver has been swept from the descending line.

15. Double-soled shoes will usually prevent blowup if the diver wears the smallest suit he can use.

**NOTE:**

\* Take 1 extra minute from last stop to next stop. Means:  
To add 1 minute to second stop. (U. S. Navy Diving Manual  
NavShips 250-538, Sec. 1.5.4, page 110, paragraph (d)).

**PARTIAL PRESSURE 60**

Time of Dive	To 1st st	feet and minutes 40	Total time
10	4	0	4
20	4	0	4
30	4	0	4
40	4	0	4
0	4	0	4
80	2	6	8
100	2	7	9
120	2	9	11
240	2	13	15

**PARTIAL PRESSURE 70**

Time of Dive	To 1st Stop	feet and minutes 40	Total time
10	3	6	9
20	3	7	10
30	3	9	12
40	3	10	13
60	3	15	18
80	3	17	20
100	3	22	25
120	3	25	30
140	3	27	30
160	3	29	32
180	3	31	34
200	3	31	34
220	3		
240	3	33	36



PARTIAL PRESS RE 100

Time of Dive	To 1st Stop	feet and minutes 40	Total Time
10	3	10	13
20	3	17	20
30	3	24	27
40	3	31	34
60	3	47	50
80	3	56	
	3	63	
120	3	67	70
140	3	70	73
160	3	72	75
180	3	73	76
200	3	73	76
220	3	73	76
240	3	75	78

PARTIAL PRESSURE 110

Time of Dive	To 1st Sto	feet and minutes 40	Total Time
10	3	12	15
20	3	21	24
30	3	31	34
40	3	3	42
80			
100	3	75	
120	3	78	
140	3		
160	3	83	
	3		
200	3	84	87
220	3	85	88
240	3	86	89

NOTE: 1. Add fractions of seconds.  
Example: 26.4 = 27 seconds.

2. Drop fractions of feet.  
Example: 47.5 = 47 feet per minute.

4. For depths exceeding 120 feet, use 100 pounds over depth pressure. During the ascent, the pressure may be reduced to 50 pounds over the depth pressure at about 120 feet. This reduction decreases the noise level in the helmet and provides for better communications.

\* 5. During the ascent, the diver may be shifted to a low pressure bank on the manifold. This affects economy in gas consumption and does not change the Partial Pressure Table in use as all decompression is computed for 14 percent, effective, oxygen.

6. Keep the petcocks between cutoff valves on the manifold open except for the line carrying the gas in use.

7. Before putting the diver over the side, be sure he is breathing helium. This can be determined after closing the faceplate, by having the diver start counting and ventilating. The characteristic voice change and the change in the sound of the gas going through the high pressure nozzle fitting will indicate when he is on helium.

8. Take frequent short ventilations during the descent. Ventilate upon reaching bottom, and as necessary while on the bottom.

9. All divers must know and be alert to recognize the following listed symptoms of oxygen poisoning:

- a. Twitching of muscles, especially about the face.
- b. Irritability.
- c. Visual disturbances (pipeline vision).
- d. Ringing in ears.
- e. Nausea.
- f. Dizziness.

If symptoms occur during the water stops, notify topside immediately and stand by to ventilate. The gas supply will be shifted to air or to

\* After "bank" insert "not less than 16 ft"

PARTIAL PRESSURE 140

Time of Dive	To 1st Stop	feet and minutes		Total Time
		50	40	
10	3	0	1	22
			4	
30	3	0	49	52
40	3	0	62	65
60	3	0	82	85
80	3	0	4	97
00		0	99	
1		0		
			9	1
				4
20				
240			99	

PARTIAL PRESSURE 150

Time of Dive	To 1st Stop	feet and minutes			Total Time
		60	50	40	
10	3	0	10	11	24
	3	0			
			0		
0	3	7			
100			7		
1	3	7			
160	3				
180	3		1		

### PARTIAL PRESSURE 160

Time of Dive	To 1st Dive	feet and minutes				Total Time
		70	60	50	40	
10	3	0	0	10	12	25
20	3	0	7	10	33	53
30	3	0	7	10	0	70
40	3	0	7	10	65	85
60	3	0	7	10	84	4
80	3	0	7			
0	3	0	7	13	99	122
	3	0	9	16		127
	3	0	15	16	99	3
160	3	0	18	16	99	136
180	3	0	20	16	9	138
200	3					0
20	3	0	23		99	41
240	3	7	19	16	99	144

PARTIAL PRESSURE 190

Time of Dive	To 1st Stop	feet and minutes					Total Time
		80	70	60	50	40	
10	4	0	7	0	10	20	41
20	4	0	7	0	10	44	65
30	4	0	7	4	10	67	92
40	4	7	0	8	10	81	110
60	4	7	5	11	10	96	133
80	4	7	9	15	15	9	149
100	4	7	3	1	1	99	
120	4	7	17	2		99	1
140	4	9	19	23	16	9	170
	4	1			1	99	7
180	4	13	21	23	16	99	176
200	4	14	22	23	16	9	178
220	4	5	23	23	1	99	10
240	4	17	23	23	16	99	182

PARTIAL PRESSURE 200

Time of Dive	To 1st Stop	feet and minutes						Total Time
		90	80	70	60	50	40	
10	4	0	0	7	0	10	22	43
20	4	0	7	0	2	10	50	73
30	4	0	7	0	7	10	69	97
40	4	0	7	4		10	84	118
0	4	0	7	9		12	3	
	4	7	3		8	15	99	9
100	4	7	6	16	21	16	99	169
120	4	7	8	20	23	16	99	177
140	4	7	11	21	23	16	99	181
160	4	7	15	23	23	16		187
1		7	17			1		
200		7				1		
2	4	7	0		3		99	
				23	23		99	19

PARTIAL PRESSURE 230

Time of Dive	To 1st St	feet and minutes								Total Time
		110	100	90	80	70	60	50	40	
*10	4	0	0	0	7	0	1	10	30	53
20	4	0	0	7	0	3	7	10	61	2
30	4	0	0	7			9	10	1	19
40	4	0	7	0	6	9	11	10		140
0	4	0	7	4	9		18		99	
80	4	0	7	8	12	17	21	16	9	184
100	4	0	7	12	1	20	2	1	99	
120	4	0		14	9	23	23		99	
140	4	0	10	16	20	23	23	16	99	211
160	4	7	6	18	20	23	23	16	99	216
180	4	7	7	19	20	23	23	1	9	218
200	4	7	9	19	20	2	23			20
	4	7	11	19	20	2	23	1	99	222
240	4	7	13	19	20	23	23	16	99	224

\* Take 1 extra minute from 1st stop to next stop

PARTIAL PRESSURE 240

Time of Dive	To 1st Sto	feet and minutes								Total Time
		110	100	90	80	70	60	50	40	
10	4	0	0	7	0	0	3	10	33	57
20	4	0	7	0	1	4	7	10	65	98
30	4	0	7	0	5	7	10	10	85	128
40	4	7	0	3	7	9	13	11	95	
60	4		0	8	10	14	18	15	99	175
0	4		3	0	1		23			194
10	4	7		12	17	23	23		99	207
120	4	7	7	16	19	23	23	16	99	214
140	4	7	11	16	20	23	23	16	99	219
160	4	7	13	19	20	23	23	16		224
180	4	8		19		23		1	99	227
200	4	8	17	19	20	23	23	16	99	229
220	4	9	17	19	20	23	23	16	99	230
2	4		17	9	20		23			232

PARTIAL PRESSURE 270

Time of Dive	To 1st	feet and minutes										Total Time
		130	120	110	100	80	70	60	50	40		
*1		0	0	0	0	0	4	10	10	40		
20		7	7	2	3	9	10	1	16	92		
30	4	7	7	7	7	0	1					
40		7	7	1	1	2	3					
120		4	4	14	9					9		97
40		7	7	15	17							8
0	4	7	9	17	9	2						2
		7	9	17	9							40
		7	7	17	17							
4		7	3	1	9	23	3					5
4		7	7	1	9	23	23					
extra		7	7	9	9	3						
		rem st stop to next stop										

27

PARTIAL PRESSURE 280

Time of Dive	To 1st	feet and minutes										Total
		130	120	110	100	80	70	60	50	40		
*1		0	0	0	0	0	0	0	0	40		
30		7	7									
40		7	7									
0		7	7									
80		7	3	8	11	14	17	23	23	16		
100		7	5	11	13	16	23	23	23	16		
		7	7	16	17	19	23	23	23	16		
140		7	7	16	17	19	23	23	23	16		
4		7	7	16	17	19	23	23	23	16		
4		10	16	17	19	23	23	23	23	16		
4		12	16	17	19	23	23	23	23	16		
extra		at stop to next stop										

PARTIAL PRESSURE 310

Time of	To 1st	feet and minutes	00	10	20	30	40	50	60	Total Time
		0	6	1						
			8							
7	1	9								3
		12	14	17	19	20	23	1		
		15	16	17	19	20	23	23	16	99
			16	17	19	20	23	2		
		15	16	17						
		15	16	17	19	20	23	23	6	
#10			0	0	0	2	3	3		Total Time
						5				141
30			0	7	0	1	6			175
			0							199
										231
										267
										288
										290
										293
										294
#	extra	ROI	at stop to next stop							
				16	17	19	20			



PARTIAL PRESSURE 350

Time of Dive	To 1st	feet and minutes										Total Time			
		170	160	150	140	130	120	110	100	80	70		60	50	40
#10	5	0		7	0	0	0	0	3	4	7			1	103
#20	5			7	0	0	1	4	8				0	90	157
30	5			0	0	3	5	5	9	13		14	98	191	
40	5	0	7	0	2	4	6	7	10	13	16	22	99	215	
60	5	7	0	3	5	6	9	10	16	18	21	23	99	251	
80	5			7	7	8	11		9	20	2		99	273	
100	5	7	2	8	8	12	13	16	17	20	23	16	99	288	
120	5	7	4	9	11	13	15	16	17	20	23	16	99	297	
140	5	7	6	11	13	14	15	16	17	20	23	16	99	304	
160	5	7	9	11	13	14	15	16	17	20	23	16	99	307	
180	5	8	9	12	13	14	15	16	17	20	23	16	99	309	
00		8	11	12	13	14	15	16	17	20	23	16		1	
2			11	12		4	15		9	23	23			3	
240					3		1		17	23	23			4	

\* Take extra from at stop to next stop

PARTIAL PRESSURE 360

Time of Dive	To 1st	feet and minutes										Total Time			
		180	170	160	150	140	130	120	110	100	80		70	60	50
#20	5	0	0	7	0	0	0	0	5	7	5	13	10	94	163
30	5	0	0	7	0	1	4	4	7	8	9	18	14	99	16
40			7	0	1			7	8	14	17	23	99	99	
60	5	0	7	0	5	5	8	8	11	16	19	23	16	99	257
80	5	0	7	2	7	7	10	11	13	17	20	23	16	99	27
100		0	0	7	7	7	10	11	13	17	20	23	16	99	294
0				7						3	3			99	303
1			4	9					17	2	2			99	
										23	23			99	
5			1	12	13				17	19	20	23		99	3
															7
															31

extra stop to next stop

USNADM Table 1-13 1959  
Side 1.5.4

PARTIAL PRESSURE 390

Time of Dive	To 1st	feet and minutes											Total Time						
		200	190	180	170	160	150	140	130	120	110	80		70	60	50	40		
*20	5	0	0	0	0	7	0	0	0	0	2	3	3	4	7	7	10	8	117
*30		0	0	0	0	0	0	1	2	4	5	8	10	12	12	19	16	5	174
40		0	0	7	0	0	3	5	6	6	8	13	13	14	21	23	1	99	237
0	5	0	7	0	2	5	8	8	9	11	5	19	20	23	23	16	99	273	297
80	5	0	7	0	5	7	8	9	11	12	16	17	19	20	23	23	16	99	297
100	5	0	7	2	7	8	9	11	14	15	16	17	19	20	23	23	16	99	311
120	5	0	7	5	8	9	11	13	14	15	16	17	19	20	23	23	16	99	320
140	5	7	0	7	10	10	12	13	14	15	16	17	19	20	23	23	16	99	326
	5	7	7	9	10	11	12	13	14	15	16	17	19	20	23	23	16	99	330
180	5	7	3	9	10	11	12	13	14	15	16	17	19	20	23	3	99	32	32
200	7	7	10	0	11	12	13	14	1	1	1	9	9	20	3	3	1	99	335
220	5	7	7	10	1	1	16	17	19	20	23	23	16	99	99	99	99	337	337
240	5	7	8	10	10	11	12	13	14	15	16	17	19	20	23	23	1	99	338

\* Take extra minute from st stop to next stop.

PARTIAL PRESSURE 400

Time of Dive	To 1st	feet and minutes											Total Time								
		210	200	190	180	170	160	150	140	130	120	110		100	90	80	70	60	50	40	
*10	5	0	0	0	0	7	0	0	0	1	3	3	3	8	8	10	14	12	96	179	
*20	5	0	0	0	0	0	0	1	4	4	4	5	8	11	20	19	16	99	21	21	
*30	5	0	0	0	0	0	4	4	4	5	11	11	20	23	23	3	99	24	24	24	
40	5	0	0	7	0	5	5	6	7	8	11	13	16	19	23	3	16	99	279	279	
60	5	0	7	0	7	8	8	10	12	12	17	17	23	23	3	3	16	99	301	301	
0		0	0	0	0	7	8	10	14	14	17	17	23	23	3	3	1	99	318	318	
120		2	2	2	2	9	1	1	13	4	17	17	19	20	0	23	1	99	7	7	
140		0	0	0	0	0	11	12	13	14	15	16	17	19	20	23	23	16	99	330	330
180	5	0	7	3	10	10	11	12	13	14	15	16	17	19	20	23	23	16	99	333	333
	5	0	0	5	10	10	11	12	13	14	15	16	17	19	20	23	23	16	99	335	335
200	5	7	7	9	10	10	1	14	14	14	17	17	20	20	20	3	9	99	3	3	3
240	5	7	9	9	9	10	1	14	14	14	17	17	19	20	20	3	2	99	3	3	3

next stop

om

extra

LOW PRESSURE RECOMPRESSION METHOD USING 100% OXYGEN

METHOD TO BE USED WHEN COMPLETE RELIEF OF SYMPTOMS OCCURS WITHIN 10 MINUTES AT 60 FOOT DEPTH

E SURFACE

- (1) PATIENT IS TAKEN FROM THE SURFACE TO 60 FEET ON O2. PATIENT REMAINS ON O2 FOR 40 MINUTES.
- (2) LEAVE 60 FOOT STOP. DECOMPRESS AT THE RATE OF 1 FT/MINUTE ON O2 TO 30 FOOT STOP
- (3) REMAIN AT 30 FOOT STOP FOR 30 MINUTES ON O2.
- (4) DECOMPRESS FROM 30 FOOT STOP TO THE SURFACE AT THE RATE OF 1 FT./MINUTE, ON O2.

(TOTAL TREATMENT TIME: 2 HOURS @ 10-MINUTES)

10

2

30

DEPTH  
IN FT.  
S.W.

10

20 30 40 50 60 70 80 90

TIME (MINUTES)

SURFACE



10

DEPTH  
FEET  
S.W.

- (1) TAKE THE PATIENT FROM THE SURFACE ON O<sub>2</sub> 100 FEET FOR 30 MIN
- (A) THEN ON AIR OR 80-20 HE O<sub>2</sub> FOR 15 MINUTES
- (B) THEN ON O<sub>2</sub> FOR 30 MINUTES AGAIN.

(TOTAL TIME) TO  
THE 20 FOOT STOP ON O<sub>2</sub> - AT  
OR HERE FOR 15 MINUTES.

YES.

(TRIAL TIME) R.P.  
SURFACE AT THE RATE OF 1 FC

71A. TREATMENT TIME: 4 HOURS

AIR OR  
80-20 HE O<sub>2</sub>

OXYGEN

20 / 150 18

IE = T

L TE

R 15 MINUTES WILL PERMIT  
N BE REPEATED AFTER A SHV  
PLETED. THE USE OF A LONG

**FIGURE 1.**

**MINIMAL-PRESSURE, OXYGEN RECOMPRESSION TREATMENT OF DECOMPRESSION SICKNESS**

**METHOD USED WHEN RELIEF OF SYMPTOMS IS COMPLETE WITHIN 10 MINUTES AT 60 FEET**

**COMMENCE O<sub>2</sub> BREATHING PRIOR TO DESCENT. DEPTH-TIME SCHEDULES SHOULD BE FOLLOWED WITH CARE.**

DEPTH (FEET)	TIME (MINUTES)	BREATHING MEDIA	(MIN.)
60	20	O <sub>2</sub>	20
60	5	AIR	25
60	20	O <sub>2</sub>	45
60-20	30	O <sub>2</sub>	75
20	5	AIR	80
30	20	O <sub>2</sub>	100
30	5	AIR	105
30-0	30	O <sub>2</sub>	135

PATIENT DESCENT TIME  
UTES  
FEET

TO  
RELIEF

ASCENTS ARE CONTINUOUS  
PM

AND MOL  
CHAMBER.

IF  
HALT ASCENT  
WHILE VENTILATING THE

L  
F  
MINUT  
SURFACE

**METHOD USED WHEN RELIEF OF SYMPTOMS IS NOT COMPLETE WITHIN 10 MINUTES AT 60 FEET**

60	20	O <sub>2</sub>	20
60	5	AIR	25
60	20	O <sub>2</sub>	45
60	5	AIR	50
60	20	O <sub>2</sub>	70
60	5	AIR	75
60-30	30	O <sub>2</sub>	105
30	15	AIR	120
30	60	O <sub>2</sub>	180
30	15	AIR	195
30	60	O <sub>2</sub>	255
30-0	30	O <sub>2</sub>	285

IF COMPLETENESS OF  
FUL AFTER MIN-  
UTES BREATHING T

IF SYMPTOMS RECUR, FRESH SYMPTOMS  
APPEAR, OR THE PATIENT'S CONDITION WORSE-  
ENS, TURN TO 60 FEET AND USE

IF  
ET AT 60 FEE  
PROCEED WITH THE 285 MINU

COMMIT  
2A,

MINUT

A MEDICAL OFFICER QUALIFIED IN  
DIVING, OR THE DIVING SUPERVISOR  
(DIVING OFFICER; MASTER DIVER)  
TEND THE 285 MINU

UTES

2. The decompression can be calculated for each case. However, since the emergency may occur at any point from the bottom to the last stop, it is impractical to attempt to cover all of the possibilities in tables.

3. The table is simple. Schedules are provided for each 50 feet. Select the one next deeper than the actual depth unless it is exactly at an even 50-foot figure.

4. In the event of an emergency when diving with He<sup>0</sup>2, the rate of ascent to first stop on emergency tables should comply with the rate of ascent to first stop as listed in PP Tables, but not normally exceed sixty feet per minute. The rate of ascent on subsequent stops using Emergency Air Tables is not critical as long as the full decompression is received at each stop.

#### OXYGEN FOLLOWING A HELIUM-OXYGEN DIVE

1. Recompression chambers equipped with oxygen are available at any helium-oxygen diving operation. Surface decompression may be used as a routine procedure, as described in the following paragraphs:

2. In tables where the first stop is 40 feet, bring the diver to 40 feet, shift to oxygen, and stay 10 minutes. Surface the diver in 1 minute, and return him to 40 feet in the recompression chamber on oxygen for the full time of the 40-foot stop. Not more than 5 minutes should elapse from the time of leaving the water stop to reaching the chamber stop. During the last 5 minutes of decompression time, surface the diver at a uniform rate.

Example:	Partial Pressure	100
	Time of dive (Minutes)	40
	Leave Bottom	0
(Ventilate -)	Reach 40 feet	3
(25 cu/ft Oxygen)	Leave 40 feet	13
	Reach surface	14
	Leave surface	16
	Reach 40	16 1/2
	Leave 40	42 1/2
	Reach surface	47 1/2

XI

SAMPLE OF HOW TO COMPLETE RATE OF ASCENT TABLE

	10	11	12		1	1	16	1	18	1	20	21	22	2	2
200	10	16	22	28	34	40	42	44	46	48	50	----75 FPM----			
150	10	14	18	22	26	30	32	34	36	38	40	42	44	46	48
100	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
50	10	10	10	10	10	10	12	14	16	18	20	20	20	20	20

Seconds between stops:

Distance between stops \* 60 seconds = Seconds  
 Feet per minute

Example: 20 Feet \* 60 Seconds = Seconds  
 30 FPM

$$\frac{1200}{30} = 40 \text{ Seconds Between Stops}$$

2. The depth of the stop and the supply of oxygen percentage are the variable factors. Interpolate between the listed oxygen percentages, but use the rates for listed depths without interpolation. Example: Use the 297 foot / 29 minute dive, 20 %O<sub>2</sub>. Determine the rate of ascent from the first stop to the second as follows:

From	Distance	Rate of	Time
Ft.	Ft.	Ascent	Min.
		Ft./Min.	
120-100	20	40	0.5
100- 90	10	30	<u>0.3</u>
Sum	-----	-----	0.8

## HELIUM-OXYGEN DECOMPRESSION TABLE

1. Decompression schedules are given for each 10 feet of partial pressure from 60 to 410 and for bottom times of 10 to 240 minutes in increments of about 10 minutes.

2. The evaluation made to date on the schedule with longer exposure has been inadequate. There is some doubt as to their value. When priorities permit, complete evaluations will be made and necessary corrections issued.

3. Details on the use of the Helium-Oxygen Decompression Table are;

A. To obtain the decompression schedule, use the partial pressure group that is exactly equal to or is next greater than that you computed. Use the bottom time that is exactly equal to or is next longer than the actual bottom time of the dive. Do not interpolate.

Example: Assume the bottom time of the 297 foot dive above was 19 minutes. The partial pressure was 270.6, so the proper decompression schedule is a partial pressure of 280 and a bottom time of 20.

B. Obtain the rate of ascent to the first stop by dividing the distance in feet from the bottom to the first stop by the number of minutes listed in the "To The First Stop" column of the proper decompression schedule.

Example: Use the dive and decompression schedule above. The distance to the first stop is  $297 - 120 = 177$  feet. The "4" listed in the "To The First Stop" column means that you are to take 4 minutes in ascent. Divide 177 by 4 and obtain a rate of about 44 feet per minute.

C. Remain at the first stop for the number of minutes specified (usually 7).

D. Obtain the rate of ascent between subsequent stops as instructed on the following page under use of the "rate of Ascent Table". Include the time of ascent and the time spent at the subsequent stop to total with the time specified for the stop.





C. The rate of ascent between stops varies and is given for various depths in a separate table.

D. The time of ascent from one stop to the next is included in the time of the subsequent stop.

E. Positive diving is not allowed in a twelve hour period.

3. The Helium-Oxygen decompression tables comprise:

A. Partial Pressure Table 1 - 12.

B. Helium-Oxygen Decompression Table 1 - 13.

C. Rate of Ascent 1 - 14.

Emergency Table HeO<sub>2</sub> Table 1 - 15.

ETC

is, 2.0 atmospheres is the  
(arts. 1.5.11. and 1.5.7.).  
for a gas mixture used  
determined from the  
depth):

Maximum oxygen percentage =  $\frac{D + 33}{297 + 33}$

As exposure time increases, the maximum safe oxygen partial pressure decreases. (See 1.5.7(8)). Therefore, in dives longer than 30 minutes bottom time, substitute the maximum oxygen partial pressure from Table 1 - 11 for 2.0 in the formula given (and in art. 2.6.3(21)).

$$1. \quad 2.0 \text{ Atmos.} \cdot 33 = \text{Maximum } O_2 \\ 297 + 33$$

$$2. \quad \frac{6600}{330} = \text{Maximum } O_2 \quad 3. \quad 33$$

III

3. In tables where the first stop is other than 40 feet, give decompression as listed until the diver reaches the 40 foot stop. Remain at 40 feet for the length of time equal to the 50-foot stop. Surface the diver in 1 minute and return him to 40 feet in the recompressions chamber on oxygen for the full time of the 40-foot stop. Not more than 5 minutes should elapse from leaving the water stop to reaching the chamber stop. During the last 5 minutes of decompression time, surface the diver at a uniform rate.

Example:	Partial Pressure	160
	T of d	
	Leave Bottom	0
	Reach 60	3
	Leave 60	10
	Reach 50	10 1/2
	Ventilate 25 cu/ft oxygen	
	Leave 50	20
	Reach 40	20 1/2
	Leave 40	30
	Reach surface	31
	Leave surface	32 1/2
	Reach 40	33
	Leave 40	93
	Reach surface	98

#### AIR OR HELIUM FOLLOWING A HELIUM - OXYGEN

The use of air or helium-oxygen mixtures during surface decompression from a helium-oxygen dive is strictly an emergency procedure. The instructions in article 1.5.4 on emergency shifts to air or helium-oxygen mixture apply to surface decompression.

#### NOTES ON HELIUM - OXYGEN DIVING

1. Do not use mixtures containing less than 16 percent oxygen, except for depths over 380 feet, absolute.
2. Do not exceed a 65 feet per minute descent.

9. All divers must know and be alert to recognize the following listed symptoms of oxygen poisoning:

- A. Twitching of muscles, especially about the face.
- B. Irritability.
- C. Visual disturbances (pipeline vision).
- D. Ringing ears.
- E. Nausea.
- F. Dizziness.

If symptoms occur during the water stops, notify topside immediately and stand by to ventilate. The gas will be shifted to air or to helium-oxygen and the diver ordered to ventilate.

Prompt reporting of symptoms and fast shifting from oxygen frequently will relieve the symptoms before the diver becomes unconscious.

If symptoms occur during the chamber stop, remove oxygen mask.

In either case, the remainder of the decompression is carried out by following the Emergency Helium-Oxygen Table or Emergency Air.

10. While breathing oxygen, remain as quiet as possible. Under no circumstances should the diver attempt to clear stageliness or work while on oxygen stops.

11. In the recompression chamber, the mask must be leakproof and snugly fitted to insure the breathing of pure oxygen. At 40 feet, the average diver will use between 5 to 6 pounds of oxygen per minute from one cylinder.

12. During surface decompression, a tender should always be in the recompression chamber when the diver is on oxygen.

13. With over 400 feet of airhose rigged, use 100 pounds excess pressure for ventilating at the first oxygen stop. Drop the pressure to 50 pounds excess when the diver goes on closed circuit.

4. Maintain 100 pounds of gas over bottom pressure. The pressure may be reduced to 50 pounds during decompression at depths of less than 120 feet.

5. If the diver, while on the bottom, develop symptoms of inadequate ventilation, there should be no hesitation on his part to bypass the venturi supply by periodically open his control valve as conditions warrant. To compensate for this excess supply the chin button will have to be used more frequently to prevent blowup. Upon reaching the surface, an investigation for the cause of the inadequate ventilation should be immediately undertaken.

6. While breathing oxygen at the 50 and 40 foot stops, the diver must keep any form of exertion to an absolute minimum since increased activity increases susceptibility to oxygen toxicity.

7. Prior to putting the diver down, ventilate the hose to insure that the diver is actually breathing a helium-oxygen mixture. The change in the tone of the diver's voice as he begins to breath helium is distinct and easily recognized.

8. Divers must be alert to recognize the symptoms of oxygen poisoning while at the oxygen stop. At the first indication of trouble, notify topside and stand by to ventilate. The diving supervisor should immediately order the manifold to shift to air or heliu-oxygen and the diver to ventilate. The symptoms of oxygen poisoning include nausea, twitching of muscles, ringing of ears, visual disturbances and dizziness.