

(9) For tunnels of greater dimension than indicated in figures 5 to 12, or for modifications or combination of sections of timbering for the same, drawings and design calculations shall be submitted to the industrial commission for approval. The use of metal liners is subject to the approval of the industrial commission.

(10) Tunnel excavations in which men are permitted to work shall not be less than 3 feet wide nor less than 4 feet in height. These measurements apply to distance between timbers.

(11) Any metal shield used for tunnel work shall be of a design subject to the approval of the industrial commission.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.22 Mechanical haulage. (1) When mechanical haulage is used, care shall be taken that the speed is not excessive depending upon the grades and condition of the tracks. No cars shall be pushed underground where it is practical to draw and all locomotives shall be equipped with headlights and gongs. Trolley poles shall be trailed whenever it is possible to do so. No locomotive shall be operated by a person under 18 years of age. No gas locomotive shall be used in any tunnel.

(2) Standing cars shall be blocked.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind 6.23 Sumps. All sumps shall be securely covered or fenced except when being cleaned or repaired.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Part IV

ADDITIONAL RULES FOR WORK WHEN DONE UNDER COMPRESSED AIR

Ind 6.24 Hours of work. (1) A normal work period of operation regularly scheduled in accordance with Table 9 and 10 in Appendix A and B. Under emergency conditions, when necessary to prevent loss of life, the project or equipment, a person may be under compression for longer than the normal work period, in which case special consideration must be given to a longer decompression time.

(2) No person shall be subjected to pressure in excess of 50 pounds.

(3) The maximum pressure attained for a duration of more than 15 minutes in any work period shall be the "basic pressure" for that period.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; r. and recr. Register, September, 1970, No. 177, eff. 10-1-70.

Ind 6.25 Period of compression. (1) When workmen enter the lock, air pressure shall not exceed 5 pounds during the first minute, then the pressure shall be held constant for an interval long enough to ascertain whether workmen are affected, and a similar pause shall be made after each 5 pounds raise in pressure.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.

Ind. 6.26 Decompression. (1) No person shall be permitted to pass to open air from a chamber in which work is being done under pressure except after decompression in an air lock in accordance with the provisions of Appendix A and B.

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(4) (a) When it is not reasonably practical to provide an approved man lock in direct connection with a working chamber, decompression may be accomplished as follows:

1. A separate decompression chamber meeting all the requirements of a man lock shall be provided at a location such that the total time spent in primary decompression in the working chamber air lock at a reasonably rapid rate, going from that air lock to the decompression chamber, and recompression in that chamber shall not exceed 5 minutes. This decompression chamber shall be in addition to the required medical lock. The medical lock shall not be used for this purpose.

2. Recompression in the decompression chamber shall be to a pressure substantially equal to the pressure of the working chamber which it is serving.

3. Final decompression in the decompression chamber shall be in accordance with requirements of Appendix A and B.

(5) Posted conspicuously inside of and at the entrance to each man lock or decompression chamber shall be a copy of Appendix A and B and a schedule showing the hours for starting and ending work periods and rest intervals for each shift at the pressure then in use in the work chamber. Violations of these rules shall be noted on the record of the individual involved.

APPENDIX A

Decompression Tables

1. Explanation. The decompression tables are computed for working chamber pressures from 0 to 14 pounds, and from 14 to 50 pounds per square inch gage inclusive by 2-pound increments and for exposure times for each pressure extending from $\frac{1}{2}$ to over 8 hours inclusive. Decompressions will be conducted by 2 or more stages with a maximum of 4 stages, the latter for a working chamber pressure of 40 pounds per square inch gage or over.

Stage 1 consists of a reduction in ambient pressure ranging from 10 to a maximum of 16 pounds per square inch, but in no instance will the pressure be reduced below 4 pounds at the end of stage 1. This reduction in pressure in stage 1 will always take place at a rate not greater than 5 pounds per minute.

Further reduction in pressure will take place during stage 2 and subsequent stages as required at a slower rate, but in no event at a rate greater than 1 pound per minute.

Decompression Table No. 9 indicates in the body of the table the total decompression time in minutes for various combinations of working chamber pressure and exposure time.

Decompression Table No. 10 indicates for the same various combinations of working chamber pressure and exposure time the following:

- a. The number of stages required;
- b. The reduction in pressure and the terminal pressure for each required stage;
- c. The time in minutes through which the reduction in pressure is accomplished for each required stage;
- d. The pressure reduction rate in minutes per pound for each required stage;

Note: We are informed by Dept of Industry, Labor and Human Relations that references to tables on this page are in error. Corrected page will follow.

IMPORTANT NOTE: THE PRESSURE REDUCTION IN EACH STAGE IS ACCOMPLISHED AT A UNIFORM RATE. DO NOT INTERPOLATE BETWEEN VALUES SHOWN ON THE TABLES. USE THE NEXT HIGHER VALUE OF WORKING CHAMBER PRESSURE OR EXPOSURE TIME SHOULD THE ACTUAL WORKING CHAMBER PRESSURE OR THE ACTUAL EXPOSURE TIME, RESPECTIVELY, FALL BETWEEN THOSE FOR WHICH CALCULATED VALUES ARE SHOWN IN THE BODY OF THE TABLES.

Examples:

Example No. 1

4 hours working period at 20 pounds gage

Decompression Table No. 1

20 pounds for 4 hours,

Total Decompression Time..... 43 minutes

TABLE 9.—TOTAL DECOMPRESSION TIME—MINUTES

Work Pressure psig	Working Period—Hours										
	½	1	1½	2	3	4	5	6	7	8	Over 8
0-12.....	3	3	3	3	3	3	3	3	3	3	3
14.....	6	6	6	6	6	6	6	6	16	16	32
16.....	7	7	7	7	7	7	17	33	48	48	63
18.....	7	7	7	8	11	17	48	63	63	73	87
20.....	7	7	8	15	15	48	63	73	83	103	113
22.....	9	9	16	24	38	68	93	103	113	128	133
24.....	11	12	23	27	52	92	117	122	127	137	151
26.....	13	14	25	34	69	104	126	141	142	142	163
28.....	15	23	31	41	98	127	143	153	153	165	183
30.....	17	28	38	62	105	143	165	168	178	188	204
32.....	19	35	43	85	126	163	178	193	203	213	226
34.....	21	39	53	98	151	178	195	218	223	233	248
36.....	24	44	63	113	170	198	223	233	243	253	273
38.....	28	49	73	128	178	203	223	233	253	263	278
40.....	31	49	84	143	183	213	233	248	253	278	288
42.....	37	56	102	144	189	215	245	260	263	268	293
44.....	43	64	118	154	199	234	254	264	269	269	293
46.....	44	74	139	171	214	244	269	274	289	299	318
48.....	51	89	144	189	229	269	299	309	319	319	---
50.....	58	94	164	209	249	279	309	329	---	---	---

Decompression Table No. 10

Stage 1

Reduce pressure from 20 pounds to 4 pounds at the uniform rate of 5 pounds per minute

16

Elapsed time stage 1: 5..... 3 minutes

Stage 2 (final stage)

Reduce pressure at a uniform rate from 4 pounds to 0 pound gage over a period of 40 minutes

Rate—0.10 pounds per minute or 10.00 minutes per pound

Stage 2 (final) elapsed time..... 40 minutes

Total Time..... 43 minutes

Example No. 2

5-hour working period at 25 pounds gage

Decompression Table 1

24 pounds for 5 hours

Total Decompression Time..... 117 minutes

Decompression Table No. 2

Stage 1

Reduce pressure from 24 pounds to 8 pounds at the uniform rate of 5 pounds per minute

16

Elapsed time stage 1: 5..... 3 minutes

Stage 2
 Reduce pressure at a uniform rate of 8 pounds to 4 pounds over a period of 4 minutes
 Rate—1 pound per minute
 Elapsed time, stage 2 4 minutes
 Transfer men to Special Decompression Chamber maintaining the 4-pound pressure during the transfer operation

Stage 3 (final stage)
 In the Special Decompression Chamber, reduce the pressure at a uniform rate from 4 pounds to 0 pound gage over a period of 110 minutes
 Rate—0.037 pounds per minute or 27.5 minutes per pound
 Stage 3 (final) elapsed time 110 minutes

Total Time 117 minutes

TABLE 10

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
14	½	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	1	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	1½	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	2	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	3	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	4	1	14	0	2	0.20	6
		2	4	0	4	1.00	
	5	1	14	4	2	0.20	6
		2	4	0	4	1.00	
	6	1	14	4	2	0.20	6
		2	4	0	4	1.00	
7	1	14	4	2	0.20	16	
	2	4	0	14	3.50		
8	1	14	4	2	0.20	16	
	2	4	0	14	3.50		
Over 8	1	14	4	2	0.20	32	
	2	4	0	30	7.50		
16	½	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	1	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	1½	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	2	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	3	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	4	1	16	4	3	0.20	7
		2	4	0	4	1.00	
	5	1	16	4	3	0.20	17
		2	4	0	4	3.50	

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
18	6	1	16	4	3	0.20	33
		2	4	0	30	7.50	
	7	1	16	4	3	0.20	48
		2	4	0	45	11.25	
	8	1	16	4	3	0.20	48
		2	4	0	45	11.25	
	Over 8	1	16	4	3	0.20	63
		2	4	0	60	15.00	
	½	1	18	4	3	0.20	7
		2	4	0	4	1.00	
	1	1	18	4	3	0.20	7
		2	4	0	4	1.00	
	1½	1	18	4	3	0.20	7
		2	4	0	4	1.00	
2	1	18	4	3	0.20	8	
	2	4	0	5	1.25		
3	1	18	4	3	0.20	11	
	2	4	0	8	2.00		
4	1	18	4	3	0.20	17	
	2	4	0	14	3.50		
5	1	18	4	3	0.20	48	
	2	4	0	45	11.25		
6	1	18	4	3	0.20	63	
	2	4	0	60	15.00		
7	1	18	4	3	0.20	63	
	2	4	0	60	15.00		
8	1	18	4	3	0.20	73	
	2	4	0	70	17.50		
Over 8	1	18	4	3	0.20	87	
	2	4	0	84	21.00		
½	1	20	4	3	0.20	7	
	2	4	0	4	1.00		
1	1	20	4	3	0.20	7	
	2	4	0	4	1.00		
1½	1	20	4	3	0.20	8	
	2	4	0	5	1.25		
2	1	20	4	3	0.20	15	
	2	4	0	12	3.00		
3	1	20	4	3	0.20	15	
	2	4	0	12	3.00		
4	1	20	4	3	0.20	43	
	2	4	0	40	10.00		
5	1	20	4	3	0.20	63	
	2	4	0	60	15.00		
6	1	20	4	3	0.20	73	
	2	4	0	70	17.50		

Do not interpolate, use next higher value for conditions not computed.

TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes	
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound		
			From	To				
22	7	1	20	4	3	0.20	83	
		2	4	0	30	20.00		
	8	1	20	4	3	0.20	103	
		2	4	0	100	25.00		
	Over 8	1	20	4	3	0.20	113	
		2	4	0	110	27.50		
	½	1	22	6	3	0.20	9	
		2	6	0	6	1.00		
	1	1	22	6	3	0.20	9	
		2	6	0	6	1.00		
	1½	1	22	6	3	0.20	16	
		2	6	0	13	2.20		
	2	1	22	6	3	0.20	24	
		2	6	0	21	3.50		
	3	1	22	6	3	0.20	38	
		2	6	0	35	5.85		
4	1	22	6	3	0.20	68		
	2	6	0	65	10.83			
5	1	22	6	3	0.20	93		
	2	6	0	90	15.00			
6	1	22	6	3	0.20	103		
	2	6	0	100	16.67			
7	1	22	6	3	0.20	113		
	2	6	0	110	18.35			
8	1	22	6	3	0.20	128		
	2	6	0	125	20.80			
Over 8	1	22	6	3	0.20	133		
	2	6	0	130	21.70			
24	½	1	24	8	3	0.20	11	
		2	3	4	4	1.00		
	1	1	24	8	3	0.20	12	
		2	3	4	4	1.00		
	1½	1	24	8	3	0.20	23	
		2	3	4	4	1.00		
	2	1	24	8	3	0.20	27	
		2	3	4	4	1.00		
	3	1	24	8	3	0.20	52	
		2	3	4	4	1.00		
	4	1	24	8	3	0.20	92	
		2	3	4	4	1.00		
	5	1	24	8	3	0.20	117	
		2	3	4	4	1.00		
			3	4	0	110	27.50	

Do not interpolate, use next higher value for conditions not computed.

TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes		
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound			
			From	To					
26	6	1	24	8	3	0.20	122		
		2	8	4	4	1.00			
		3	4	0	115	28.80			
	7	1	24	8	3	0.20		127	
		2	8	4	4	1.00			
		3	4	0	120	30.00			
	8	1	24	8	3	0.20			137
		2	8	4	4	1.00			
		3	4	0	130	32.50			
	Over 8	1	24	8	3	0.20	151		
		2	8	4	8	2.00			
		3	4	0	140	35.00			
	½	1	26	10	3	0.20		13	
		2	10	4	6	1.00			
		3	4	0	4	1.00			
	1	1	26	10	3	0.20			14
		2	10	4	6	1.00			
		3	4	0	5	1.25			
	1½	1	26	10	3	0.20	29		
		2	10	4	6	1.00			
		3	4	0	20	5.00			
	2	1	26	10	3	0.20		34	
		2	10	4	6	1.00			
		3	4	0	25	6.25			
3	1	26	10	3	0.20	69			
	2	10	4	6	1.00				
	3	4	0	60	15.00				
4	1	26	10	3	0.20		104		
	2	10	4	6	1.00				
	3	4	0	95	23.75				
5	1	26	10	3	0.20			126	
	2	10	4	8	1.33				
	3	4	0	115	28.80				
6	1	26	10	3	0.20	141			
	2	10	4	8	1.33				
	3	4	0	130	32.50				
7	1	26	10	3	0.20		142		
	2	10	4	9	1.50				
	3	4	0	130	32.50				
8	1	26	10	3	0.20			142	
	2	10	4	9	1.50				
	3	4	0	130	32.50				
Over 8	1	26	10	3	0.20	163			
	2	10	4	30	5.00				
	3	4	0	130	32.50				
½	1	28	12	3	0.20		15		
	2	12	4	8	1.00				
	3	4	0	4	1.00				
1	1	28	12	3	0.20			23	
	2	12	4	8	1.00				
	3	4	0	12	3.00				
1½	1	28	12	3	0.20				

Do not interpolate, use next higher value for conditions not computed.

TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
30		2	12	4	8	1.00	31
		3	4	0	20	5.00	
	2	1	28	12	3	0.20	41
		2	12	4	8	1.00	
		3	4	0	30	7.50	
	3	1	28	12	3	0.20	98
		2	12	4	10	1.25	
		3	4	0	85	21.20	
	4	1	28	12	3	0.20	127
		2	12	4	14	1.75	
		3	4	0	110	27.50	
	5	1	28	12	3	0.20	143
		2	12	4	20	2.50	
		3	4	0	120	30.00	
	6	1	28	12	3	0.20	153
		2	12	4	20	2.50	
		3	4	0	130	32.50	
	7	1	28	12	3	0.20	153
		2	12	4	20	2.50	
		3	4	0	130	32.50	
	8	1	28	12	3	0.20	165
		2	12	4	32	4.00	
		3	4	0	130	32.50	
	Over 8	1	28	12	3	0.20	183
		2	12	4	50	6.25	
		3	4	0	130	32.50	
	½	1	30	14	3	0.20	17
		2	14	4	10	1.00	
		3	4	0	4	1.00	
	1	1	30	14	3	0.20	28
		2	14	4	10	1.00	
		3	4	0	15	3.75	
	1½	1	30	14	3	0.20	38
		2	14	4	10	1.00	
		3	4	0	25	6.25	
	2	1	30	14	3	0.20	62
		2	14	4	14	1.40	
		3	4	0	45	11.25	
	3	1	30	14	3	0.20	105
		2	14	4	17	1.70	
		3	4	0	35	21.20	
	4	1	30	14	3	0.20	143
2		14	4	30	3.00		
3		4	0	110	27.50		
5	1	30	14	3	0.20	165	
	2	14	4	35	3.50		
	3	4	0	130	32.50		
6	1	30	14	3	0.20	168	
	2	14	4	35	3.50		
	3	4	0	130	32.50		
7	1	30	14	3	0.20	178	
	2	14	4	45	4.50		
	3	4	0	130	32.50		

Do not interpolate, use next higher value for conditions not computed.

TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes		
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound			
			From	To					
32	8	1	30	14	3	0.20	188		
		2	14	4	55	5.50			
		3	4	0	130	32.50			
	Over 8	1	30	14	3	0.20		204	
		2	14	4	71	7.10			
		3	4	0	130	32.50			
	½	1	32	16	3	0.20			19
		2	16	4	12	1.00			
		3	4	0	4	1.00			
	1	1	32	16	3	0.20	35		
		2	16	4	12	1.00			
		3	4	0	20	5.00			
	1½	1	32	16	3	0.20		43	
		2	16	4	15	1.25			
		3	4	0	25	6.25			
	2	1	32	16	3	0.20			85
		2	16	4	22	1.83			
		3	4	0	60	15.00			
	3	1	32	16	3	0.20	126		
		2	16	4	28	2.33			
		3	4	0	95	23.75			
	4	1	32	16	3	0.20		163	
		2	16	4	40	3.33			
		3	4	0	120	30.00			
5	1	32	16	3	0.20	178			
	2	16	4	45	3.75				
	3	4	0	130	32.50				
6	1	32	16	3	0.20		193		
	2	16	4	60	5.00				
	3	4	0	130	32.50				
7	1	32	16	3	0.20			203	
	2	16	4	70	5.83				
	3	4	0	130	32.50				
8	1	32	16	3	0.20	213			
	2	16	4	80	6.67				
	3	4	0	130	32.50				
Over 8	1	32	16	3	0.20		226		
	2	16	4	93	7.75				
	3	4	0	130	32.50				
½	1	34	18	3	0.20			21	
	2	18	4	14	1.00				
	3	4	0	4	1.00				
1	1	34	18	3	0.20	39			
	2	18	4	14	1.00				
	3	4	0	22	5.50				
1½	1	34	18	3	0.20		58		
	2	18	4	25	1.80				
	3	4	0	30	7.50				
2	1	34	18	3	0.20			98	
	2	18	4	35	2.50				
	3	4	0	60	15.00				
3	1	34	18	3	0.20				

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
36		2	18	4	43	3.10	151
		3	4	0	105	26.25	
		4	1	34	18	3	
		2	18	4	55	3.93	178
		3	4	0	120	30.00	
		5	1	34	18	3	
		2	18	4	62	4.43	195
		3	4	0	130	32.50	
		6	1	34	18	3	
		2	18	4	85	6.07	218
		3	4	0	130	32.50	
		7	1	34	18	3	
		2	18	4	90	6.43	223
		3	4	0	130	32.50	
		8	1	34	18	3	
		2	18	4	100	7.15	233
		3	4	0	130	32.50	
		Over 8	1	34	18	3	
		2	18	4	115	8.23	248
		3	4	0	130	32.50	
		1/2	1	36	20	3	
		2	20	4	16	1.00	24
		3	4	0	5	1.25	
		1	1	36	20	3	
		2	20	4	16	1.00	44
		3	4	0	25	6.25	
		1 1/2	1	36	20	3	
		2	20	4	30	1.88	63
		3	4	0	30	7.50	
		2	1	36	20	3	
		2	20	4	40	2.50	113
		3	4	0	70	17.50	
		3	1	36	20	3	
		2	20	4	52	3.25	170
		3	4	0	115	28.75	
		4	1	36	20	3	
	2	20	4	65	4.06	198	
	3	4	0	130	32.50		
	5	1	36	20	3		0.20
	2	20	4	90	5.63	223	
	3	4	0	130	32.50		
	6	1	36	20	3		0.20
	2	20	4	100	6.25	233	
	3	4	0	130	32.50		
	7	1	36	20	3		0.20
	2	20	4	110	6.88	243	
	3	4	0	130	32.50		
	8	1	36	20	3		0.20
	2	20	4	120	7.50	253	
	3	4	0	130	32.50		
	Over 8	1	36	20	3		0.20
	2	20	4	140	8.75	273	
	3	4	0	130	32.50		

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes	
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound		
			From	To				
38	½	1	38	22	3	0.20	28	
		2	22	6	16	1.00		
		3	6	0	9	1.50		
	1	1	38	22	3	0.20		40
		2	22	6	16	1.00		
		3	6	0	30	5.00		
	1½	1	38	22	3	0.20		73
		2	22	6	20	1.25		
		3	6	0	50	8.34		
	2	1	38	22	3	0.20		128
		2	22	6	30	1.88		
		3	6	0	95	15.83		
	3	1	38	22	3	0.20		178
		2	22	6	35	2.19		
		3	6	0	140	23.35		
	4	1	38	22	3	0.20		203
		2	22	6	50	3.12		
		3	6	0	150	25.00		
	5	1	38	22	3	0.20		223
		2	22	6	55	3.44		
		3	6	0	165	27.50		
	6	1	38	22	3	0.20		238
		2	22	6	70	4.38		
		3	6	0	165	27.50		
7	1	38	22	3	0.20	253		
	2	22	6	35	5.32			
	3	6	0	165	27.50			
8	1	38	22	3	0.20	263		
	2	22	6	95	5.93			
	3	6	0	165	27.50			
Over 8	1	38	22	3	0.20	278		
	2	22	6	110	6.88			
	3	6	0	165	27.50			
40	½	1	40	24	3	0.20	31	
		2	24	8	16	1.00		
		3	8	4	4	1.00		
		4	4	0	8	2.00		
	1	1	40	24	3	0.20		49
		2	24	8	16	1.00		
		3	8	4	5	1.25		
		4	4	0	25	6.25		
	1½	1	40	24	3	0.20		84
		2	24	8	16	1.00		
		3	8	4	20	5.00		
		4	4	0	45	11.25		
	2	1	40	24	3	0.20		143
		2	24	8	25	1.56		
		3	8	4	20	5.00		
		4	4	0	95	23.75		
	3	1	40	24	3	0.20		183
		2	24	8	30	1.88		
		3	8	4	30	7.50		
		4	4	0	120	30.00		
	4	1	40	24	3	0.20		

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure, psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
42	5	2	24	8	45	2.81	218
		3	8	4	35	8.75	
		4	4	0	130	32.50	
	6	1	40	24	3	0.20	293
		2	24	8	47	2.94	
		3	8	4	55	13.25	
	7	1	40	24	3	0.20	248
		2	24	8	55	3.44	
		3	8	4	60	15.00	
	8	1	40	24	3	0.20	268
		2	24	8	75	4.70	
		3	8	4	60	15.00	
	Over 8	1	40	24	3	0.20	288
		2	24	8	95	5.93	
		3	8	4	60	15.00	
	½	1	42	26	3	0.20	37
		2	26	10	16	1.00	
		3	10	4	6	1.00	
	1	1	42	26	3	0.20	56
		2	26	10	16	1.00	
		3	10	4	12	2.00	
	1½	1	42	26	3	0.20	102
		2	26	10	16	1.00	
		3	10	4	23	3.83	
	2	1	42	26	3	0.20	144
		2	26	10	16	1.00	
		3	10	4	30	5.00	
	3	1	42	26	3	0.20	189
		2	26	10	16	1.00	
		3	10	4	50	8.34	
	4	1	42	26	3	0.20	215
		2	26	10	17	1.06	
		3	10	4	65	10.83	
	5	1	42	26	3	0.20	245
		2	26	10	27	1.69	
		3	10	4	85	14.18	
	6	1	42	26	3	0.20	260
		2	26	10	27	1.69	
		3	10	4	100	16.67	
	7	1	42	26	3	0.20	
		2	26	10	27	1.69	
		3	10	4	100	16.67	

Do not interpolate, use next higher value for conditions not computed.

TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes			
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound				
			From	To						
44	8	2	26	10	30	1.88	263			
		3	10	4	100	16.67				
		4	4	0	130	32.50				
		1	42	26	3	0.20		268		
		2	26	10	35	2.19				
		3	10	4	100	16.67				
		4	4	0	130	32.50				
		Over 8	1	42	26	3			0.20	293
		2	26	10	60	3.75				
		3	10	4	100	16.67				
		4	4	0	130	32.50				
		½	1	44	28	3			0.20	
	2	28	12	16	1.00					
	3	12	4	8	1.00					
	4	4	0	16	4.00					
	1	1	44	28	3	0.20	64			
	2	28	12	16	1.00					
	3	12	4	20	2.50					
	4	4	0	25	6.25					
	1½	1	44	28	3	0.20		118		
	2	28	12	16	1.00					
	3	12	4	27	3.38					
	4	4	0	72	18.00					
	2	1	44	28	3	0.20			154	
	2	28	12	16	1.00					
	3	12	4	40	5.00					
	4	4	0	95	23.75					
	3	1	44	28	3	0.20	199			
	2	28	12	16	1.00					
	3	12	4	60	7.50					
	4	4	0	120	30.00					
	4	1	44	28	3	0.20		234		
	2	28	12	16	1.00					
	3	12	4	85	10.62					
	4	4	0	130	32.50					
	5	1	44	28	3	0.20			254	
	2	28	12	16	1.00					
	3	12	4	105	13.13					
	4	4	0	130	32.50					
	6	1	44	28	3	0.20	264			
	2	28	12	16	1.00					
	3	12	4	115	14.88					
	4	4	0	130	32.50					
	7	1	44	28	3	0.20		269		
	2	28	12	16	1.00					
	3	12	4	120	15.00					
	4	4	0	130	32.50					
	8	1	44	28	3	0.20			269	
2	28	12	16	1.00						
3	12	4	120	15.00						
4	4	0	130	32.50						
Over 8	1	44	28	3	0.20	293				
2	28	12	40	2.50						
3	12	4	120	15.00						
4	4	0	130	32.50						
46	½	1	46	30	3		0.20			

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes	
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound		
			From	To				
48	1	2	30	14	16	1.00	44	
		3	14	4	10	1.00		
		4	4	0	15	3.75		
	1 ½	1	46	30	3	0.20	74	
		2	30	14	16	1.00		
		3	14	4	25	2.50		
		4	4	0	30	7.50		
	2	1	46	30	3	0.20	139	
		2	30	14	16	1.00		
		3	14	4	35	3.50		
		4	4	0	85	21.20		
	3	1	46	30	3	0.20	171	
		2	30	14	16	1.00		
		3	14	4	47	4.70		
		4	4	0	105	26.25		
	4	1	46	30	3	0.20	214	
		2	30	14	16	1.00		
		3	14	4	65	6.50		
		4	4	0	130	32.50		
	5	1	46	30	3	0.20	244	
		2	30	14	16	1.00		
		3	14	4	95	9.50		
		4	4	0	130	32.50		
	6	1	46	30	3	0.20	269	
		2	30	14	16	1.00		
		3	14	4	120	12.00		
		4	4	0	130	32.50		
	7	1	46	30	3	0.20	274	
		2	30	14	16	1.00		
		3	14	4	125	12.50		
		4	4	0	130	32.50		
	8	1	46	30	3	0.20	289	
		2	30	14	16	1.00		
		3	14	4	140	14.00		
		4	4	0	130	32.50		
	Over 8	1	46	30	3	0.20	299	
		2	30	14	16	1.00		
		3	14	4	150	15.00		
		4	4	0	130	32.50		
	48	½	1	46	30	3	0.20	318
			2	30	14	25	1.56	
			3	14	4	160	16.00	
		1	1	48	32	3	0.20	51
			2	32	16	16	1.00	
			3	16	4	12	1.00	
			4	4	0	20	5.00	
		1 ½	1	48	32	3	0.20	89
			2	32	16	16	1.00	
3			16	4	35	2.92		
4			4	0	35	8.75		
2		1	48	32	3	0.20	144	
	2	32	16	16	1.00			
	3	16	4	45	3.75			
	4	4	0	80	20.00			

Do not interpolate, use next higher value for conditions not computed.

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TABLE 10 (Continued)

Working chamber pressure psig	Working period Hours	Decompression data					Total time decompress Minutes
		Stage No.	Pressure reduction psig		Time in stage Minutes	Pressure reduction rate Min/Pound	
			From	To			
50		3	16	4	60	5.00	189
		4	4	0	110	27.50	
	3	1	48	32	3	0.20	229
		2	32	16	16	1.00	
		3	16	4	90	7.50	
		4	4	0	120	30.00	
	4	1	48	32	3	0.20	269
		2	32	16	16	1.00	
		3	16	4	120	10.00	
		4	4	0	130	32.50	
	5	1	48	32	3	0.20	299
		2	32	16	16	1.00	
		3	16	4	140	11.67	
		4	4	0	130	32.50	
	6	1	48	32	3	0.20	309
		2	32	16	16	1.00	
		3	16	4	160	13.33	
		4	4	0	130	32.50	
	7	1	48	32	3	0.20	319
		2	32	16	16	1.00	
		3	16	4	170	14.17	
		4	4	0	130	32.50	
	8	1	48	32	3	0.20	319
		2	32	16	16	1.00	
		3	16	4	170	14.17	
		4	4	0	130	32.50	
	½	1	50	34	3	0.20	58
		2	34	18	16	1.00	
		3	18	4	14	1.00	
		4	4	0	25	6.25	
	1	1	50	34	3	0.20	94
		2	34	18	16	1.00	
		3	18	4	40	2.86	
		4	4	0	35	8.75	
	1½	1	50	34	3	0.20	164
		2	34	18	16	1.00	
		3	18	4	55	3.93	
		4	4	0	90	22.50	
	2	1	50	34	3	0.20	209
		2	34	18	16	1.00	
		3	18	4	70	5.00	
		4	4	0	120	30.00	
	3	1	50	34	3	0.20	249
		2	34	18	16	1.00	
		3	18	4	100	7.15	
		4	4	0	130	32.50	
	4	1	50	34	3	0.20	279
		2	34	18	16	1.00	
3		18	4	130	8.58		
4		4	0	130	32.50		
5	1	50	34	3	0.20	309	
	2	34	18	16	1.00		
	3	18	4	160	11.42		
	4	4	0	130	32.50		
6	1	50	34	3	0.20	329	
	2	34	18	16	1.00		
	3	18	4	180	12.85		
	4	4	0	130	32.50		

Do not interpolate, use next higher value for conditions not computed.

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APPENDIX B

The information contained in the following pages is adapted from the U. S. Navy Diving Tables and is to be used when an employe will enter a compressed air environment more than once within a 12-hour period.

The Division may accept alternate methods of decompression for repetitive exposures provided the licensed physician submits his proposed procedures to the Division for its review and approval.

The Department of the Navy is in no way liable for the use or misuse of Tables 3, 4, and 5.

Pressure (psig)	Repetitive Groups															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
4	60	120	210	300												
7	35	70	110	160	225	350										
9	25	50	75	100	135	180	240	325								
11	20	35	55	75	100	125	160	195	245	315						
13	15	30	45	60	75	95	120	145	170	205	250	310				
16	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310	
18	5	15	25	30	40	50	70	80	100	110	130	150	170	230	270	300
22	--	10	15	25	30	40	50	60	70	80	90	110	140	160	200	240
27	--	10	15	20	25	30	40	50	55	60	70	80	100	120	140	200
31	--	5	10	15	20	30	35	40	45	50	60	70	80	100	130	170
36	--	5	10	15	20	25	30	35	40	---	50	60	70	90	110	150
40	--	5	10	12	15	20	25	30	---	40	---	50	60	80	90	130
45	--	5	7	10	15	20	22	25	30	---	40	50	---	60	80	120
49	--	---	5	10	13	15	20	25	---	30	---	40	50	60	70	100

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TABLE 3

INSTRUCTIONS FOR USE

The tabulated compressed air exposure times are in minutes. The times at the various pressures in each vertical column are the maximum exposures during which a compressed air worker will remain within the group listed at the head of the column.

To find the repetitive group designation enter the table on the exact or next greater working pressure than that to which exposed and select the listed exposure time exact or next greater than the actual exposure time. The repetitive group designation is indicated by the letter at the head of the vertical column where the selected exposure time is listed.

For example: An exposure in compressed air was for 45 minutes at 26 psig. To determine the repetitive group enter the table at 27 psig (the next higher pressure, as 26 psig is not listed) and move along horizontally until 50 minutes (the next greater tabulated exposure time, as 45 minutes is not listed), then move vertically to the top of the column where "H" is shown as the repetitive group.

Note: We are informed by Dept of Industry, Labor and Human Relations that this Table 5 and instructions for use is in error. See correct Table 5 and instructions for use next following. We will publish a correction later.

TABLE 5
Effective Exposure Pressure (psig)

Repet. Group	18	22	27	31	36	40	45	49
A	7	6	5	4	4	3	3	3
B	17	13	11	9	8	7	7	6
C	25	21	17	15	13	11	10	10
D	37	29	24	20	18	16	14	13
E	40	38	30	26	23	20	18	16
F	61	47	36	31	28	24	22	20
G	73	56	44	37	32	29	26	24
H	87	66	52	43	33	33	30	27
I	101	76	61	50	43	38	34	31
J	116	87	70	57	48	43	38	34
K	138	99	79	64	54	47	43	39
L	161	111	88	72	61	53	48	42
M	187	124	97	80	68	58	52	47
N	213	142	107	87	73	64	57	51
O	241	160	117	96	80	70	62	55
Z	257	169	122	100	84	73	64	57

INSTRUCTIONS FOR USE

The compressed air exposure times listed in this table are called "residual nitrogen times" and are the times a compressed air worker is to consider he has already spent in compressed air when he starts a repetitive exposure to a specific pressure. They are in minutes.

Enter the table horizontally with the repetitive group designation from the Open Air Interval Credit Table (table 4). The time in each vertical column is the number of minutes that would be required (at the pressure listed at the head of the column) to saturate to the particular group.

For example: The final group designation from the Open Air Interval Credit Table (table 4) on the basis of a previous exposure and open air interval is "H." It is planned to re-enter compressed air at a pressure of 42 psig. What time must be added to the actual time spent in compressed air? Enter table 5 on row H. Since 42 psig is greater than 40 psig but less than 45 psig, use the longer time of 33 minutes. This means that the compressed air worker enters the compressed air environment as though he had already been at 42 psig for 33 minutes.

The exposure time listed in table 5 is added to the actual time spent in compressed air. Decompression is carried out based on the sum of the actual exposure time and the time from table 5 for the pressure encountered.

TABLE 5

Repet. Group	Repetitive Exposure Pressure (psig)							
	18	22	27	31	36	40	45	49
A	7	6	5	4	4	3	3	3
B	17	13	11	9	8	7	7	6
C	25	21	17	15	13	11	10	10
D	37	29	24	20	18	16	14	13
E	49	38	30	26	23	20	18	16
F	61	47	36	31	28	24	22	20
G	73	56	44	37	32	29	26	24
H	87	66	52	43	38	33	30	27
I	101	76	61	50	43	38	34	31
J	116	87	70	57	48	43	38	34
K	138	99	79	64	54	47	43	38
L	161	111	88	72	61	53	48	42
M	187	124	97	80	68	58	52	47
N	213	142	107	87	73	64	57	51
O	241	160	117	96	80	70	62	55
Z	267	169	122	100	84	73	64	57

INSTRUCTIONS FOR USE

The compressed air exposure times listed in this table are called "residual nitrogen times" and are the times a compressed air worker is to consider he has already spent in compressed air when he starts a repetitive exposure to a specific pressure. They are in minutes.

Enter the table horizontally with the repetitive group designation from the Open Air Interval Credit Table (table 4). The time in each vertical column is the number of minutes that would be required (at the pressure listed at the head of the columns) to saturate to the particular group.

For Example: The final group designation from the Open Air Interval Credit Table (table 4) on the basis of a previous exposure and open air interval is "H." It is planned to reenter compressed air at a pressure of 42 psig. What time must be added to the actual time spent in compressed air? Enter table 5 on row H. Since 42 psig is greater than 40 psig but less than 45 psig, use the longer time of 33 minutes. This means that the compressed air worker enters the compressed air environment as though he had already been at 42 psig for 33 minutes.

The exposure time listed in table 5 is added to the actual time spent in compressed air. Decompression is carried out based on the sum of the actual exposure time and the time from table 5 for the pressure encountered.

OPEN AIR INTERVAL CREDIT TABLE

REPETITIVE GROUP AT END OF OPEN AIR INTERVAL																
	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
Z	0:10 0:22	0:34	0:48	1:02	1:18	1:36	1:55	2:17	2:42	3:10	3:45	4:29	5:27	6:56	10:05	12:00*
	O	0:10 0:23	0:36	0:51	1:07	1:24	1:43	2:04	2:29	2:59	3:33	4:17	5:16	6:44	9:54	12:00*
		N	0:10 0:24	0:39	0:54	1:11	1:30	1:53	2:18	2:47	3:22	4:04	5:03	6:32	9:43	12:00*
			M	0:10 0:25	0:42	0:59	1:18	1:39	2:05	2:34	3:08	3:52	4:49	6:18	9:28	12:00*
				L	0:10 0:26	0:45	1:04	1:25	1:49	2:19	2:53	3:36	4:35	6:02	9:12	12:00*
					K	0:10 0:28	0:49	1:11	1:35	2:03	2:38	3:21	4:19	5:48	8:58	12:00*
						J	0:10 0:31	0:54	1:19	1:47	2:20	3:04	4:02	5:40	8:40	12:00*
							I	0:10 0:33	0:59	1:29	2:02	2:44	3:43	5:12	8:21	12:00*
								H	0:10 0:36	1:06	1:41	2:23	3:20	4:49	7:59	12:00*
									G	0:10 0:40	1:15	1:59	2:58	4:25	7:35	12:00*
										F	0:10 0:45	1:29	2:28	3:57	7:05	12:00*
											E	0:10 0:54	1:57	3:22	6:32	12:00*
												D	0:10 1:09	2:38	5:48	12:00*
													C	0:10 1:39	2:49	12:00*
														B	0:10 2:10	12:00*
															A	0:10 12:00*

INSTRUCTIONS FOR USE

Open air interval time in the table is in hours and minutes (2:20 means 2 hours and 20 minutes). The open air interval must be at least 10 minutes.

Find the repetitive group designation from Table 3 on the diagonal slope. Enter the table horizontally to select the listed open air interval time that is exactly or NEXT GREATER than the actual open air interval time. The repetitive group designation for the end of the open air interval is at the head of the vertical column where the selected open air interval time is listed.

For example: A previous compressed air exposure was for 45 minutes at 30 psig. The compressed air worker decompresses according to Table 2 and remains in open air for 1 hour and 30 minutes and wishes to find his new repetitive group designation. From Table 3 his repetitive group at the start of the open air interval is "I." Now enter Table 4 at "I" on the diagonal slope and move horizontally to the column having 2:02 listed, which is the next greater time, since 1:30 is not tabulated. The compressed air worker has lost sufficient inert gas to place him now in group "F."

TABLE 4

*NOTE: Compressed air exposures following open air intervals of more than 12 hours are not considered multiple exposures. ACTUAL compressed air exposure time will be used for the determination of decompression time for open air intervals greater than 12 hours.

Register, September, 1970, No. 177
Trench, Excavation and Tunnel Construction

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63; r. and recr. (1), (4) (a) 3, and (5) and repeal instructions and examples and create appendix A and B, and r. (2) and (3), Register, September, 1970, No. 177, eff. 10-1-70.

Ind 6.27 Gauges. (1) A recording gauge to show the rate of decompression shall be connected to each man lock. A recording gauge shall also be placed to show the air pressures in the working chamber. The dial shall be of such size that the amount of rise or fall in the air pressure within any 5 minutes shall be readily shown.

(2) There shall be on the outer side of any working chamber at least one pressure gauge, which shall be accessible at all times and shall be kept in accurate working order. Additional fittings shall be provided so that check gauges may be attached at all necessary times. Pressure gauges shall be checked every 24 hours and a record kept of such check. One gauge shall be installed near the compressor station.

(3) Whenever men are working under a lake or stream a competent man shall be placed in charge of the valves and gauges which regulate and show the pressure in the working chamber. He shall not be employed more than 8 hours in any 24. At no time shall he operate more than 2 separate air lines.

History: Cr. Register, December, 1962, No. 84, eff. 1-1-63.