Navy Experimental Diving Unit
321 Bullfinch Road
Panama City, FL 32407-7015

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THALMANN ALGORITHM PARAMETER SETS FOR SUPPORT OF CONSTANT 1.3 ATM PO_2 $HE\text{-}O_2$ DIVING TO 300 FSW

Authors:
DAVID J. DOOLETTE
F. GREGORY MURPHY
WAYNE A. GERTH

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David J. Doolette; F. Greg Murphy; Wayne A. Gerth

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14. ABSTRACT
The current Navy Dive Computer (NDC) and Navy Dive Planner (NDP) can only support 1.3 atm PO_2 He-O_2 diving to a maximum depth of 200 feet of sea water (fsw), not the 300 fsw maximum depth supported by the 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual*. In these tables, schedules for depths deeper than 200 fsw are computed using the LEM-he8n25 probabilistic decompression model with a target probability of decompression sickness (P_{DCS}) of 2.3 %. Probabilistic decompression algorithms are too computationally expensive to be implemented in a diver-worn decompression computer (dive computer) such as the NDC. Previously, the XVal-He-4 and XVal-He-4B parameterizations of the Thalmann Algorithm were developed to emulate the LEM-he8n25 2.3 % P_{DCS} 1.3 atm PO_2 He-O_2 decompression schedules for depths of 200 fsw and shallower. The Thalmann Algorithm is the computationally inexpensive deterministic decompression algorithm currently implemented in the NDC and NDP. This work refined the technique used to generate the XVal-He-4 and XVal-He-4B parameters and used the refined technique to produce new parameter sets. With the new parameter sets XVal-He-9_023, XVal-He-9_040, and XVal-He-9_050, the Thalmann Algorithm can compute decompression schedules for undersea operations to depths up to 300 fsw and with P_{DCS} near 2.3 %, 4 %, or 5 %, respectively. The Thalmann Algorithm with these parameter sets can be implemented in currently available dive computer hardware.

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INTRODUCTION

The current Navy Dive Computer (NDC) used for MK 16 MOD 1 He-O_2 diving (NSW He III 200-1.3)[1] and the Navy Dive Planner (NDP)[2] can only support MK 16 MOD 1 He-O_2 diving to a maximum depth of 200 feet of sea water (fsw), not the 300 fsw maximum normal exposure depth supported by the 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual*.[3] This depth limitation is because 1.3 atm PO_2 He-O_2 decompression schedules in the *U.S. Navy Diving Manual* for depths deeper than 200 fsw and those for depths of 200 fsw and shallower were computed using different decompression algorithms, and it is the algorithm used to calculate the shallower schedules that is implemented in NDC and NDP.

The 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual* for depths deeper than 200 fsw were computed using the linear-exponential multi-gas 'probabilistic' decompression model parameterized with the he8n25 parameter set (LEM-he8n25) in conjunction with a search algorithm to find the shortest decompression schedules not exceeding 2.3 % estimated probability of decompression sickness (P_{DCS}).[4] To facilitate producing repetitive diving schedules in the 1.3 atm PO_2 He-O_2 Decompression Tables for depths of 200 fsw or shallower, these schedules were computed with the 'deterministic' U.S. Navy Thalmann Algorithm[5,6] parameterized with XVal-He-4. XVal-He-4 is a parameter set that causes the Thalmann Algorithm to compute decompression schedules similar to those produced by LEM–he8n25 with the 2.3 % target P_{DCS} for dives to depths of 200 fsw and shallower.[4]

Producing a probabilistic decompression schedule is compute-intensive, and the required algorithm is not implemented in any diver-worn real-time decompression computer (dive computer). Deterministic decompression algorithms are not compute-intensive, and these are implemented in dive computers. It is the Thalmann Algorithm that is implemented in the NDC and NDP. XVal-He-4 will not produce schedules for 1.3 atm PO_2 dives to depths deeper than 211 fsw and is therefore unsuitable for use in an NDC in the event a diver exceeds 211 fsw depth. An empirical modification to XVal-He-4, denoted XVal-He4B, overcomes this limitation[7], and it is the XVal-He-4B Thalmann Algorithm which is implemented in the NSW He III 200-1.3 NDC and NDP. However, for dives deeper than 200 fsw, the XVal-He-4B Thalmann Algorithm produces decompression schedules with unacceptably high estimated P_{DCS}.[7] Therefore the NSW He III 200-1.3 NDC is authorized only for use to 200 fsw and there is no NDC which supports deeper 1.3 atm PO_2 He-O_2 diving.

We have identified shortcomings in the approach used to produce the XVal-He-4 and XVal-He-4B parameter sets, and developed a method to produce parameter sets to cause the Thalmann Algorithm to compute near-uniform-P_{DCS} decompression schedules across a broader range of depths and bottom times. In this report we describe the development of a parameter set for the Thalmann Algorithm that closely emulates the 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual* across the entire 300 fsw operational depth range. In addition, we describe development of parameter sets for accelerated decompression from 1.3 atm PO_2 He-O_2 dives that emulate LEM-he8n25 1.3 atm PO_2 He-O_2 decompression schedules with 4 % and 5 % target P_{DCS}. These parameter sets could be programmed into currently available dive computers and dive planning software that use the Thalmann Algorithm to compute decompression schedules.

METHODS

The general approach was to produce parameter sets for the Thalmann Algorithm that cause it to compute decompression schedules that emulate those produced by the LEM-he8n25 probabilistic decompression model. The method assumes that a large data set of schedules contains sufficient information to parameterize the Thalmann Algorithm and that the Thalmann Algorithm is sufficiently flexible to emulate LEM schedules. The validity of the former assumption has been confirmed in previous work by computing a large data set of VVal-18 Thalmann Algorithm schedules and then using the methods that will be outlined below to extract parameters from those schedules that matched the VVal-18 parameter set.[4] The latter assumption is reasonable since the Thalmann Algorithm and the LEM model have similar structures. Both are 'gas content models', which schedule decompression to limit gas supersaturation (sum of dissolved gas partial pressures greater than ambient pressure) in a collection of gas exchange compartments representing theoretical tissue sites. In both the LEM model and the Thalmann Algorithm the compartments exchange gas with the blood but not each other, and compartmental gas kinetics can transition from exponential to linear if there is sufficient compartmental gas supersaturation.

LEM-he8n25 is a probabilistic decompression model which estimates P_{DCS} of a dive profile (depth/time/breathing gas history) as a function of the duration and magnitude of gas supersaturation in three compartments. Probabilistic decompression models are calibrated by optimization of their parameters to best fit the occurrence and time of onset of decompression sickness (DCS) associated with well-defined dive profiles of actual man-dives.[8,9] In the case of LEM-he8n25, fitted model parameters include compartment gas kinetic half-times and supersaturation thresholds for risk accumulation and onset of linear kinetics. The 'he8n25' database includes 4,669 air, nitrox, heliox, and trimix dives with 242 cases of DCS and 118 cases of marginal DCS (fleeting symptoms that resolved spontaneously).[4] In conjunction with a search algorithm, probabilistic decompression models can be used to compute a decompression schedule by finding the shortest schedule not exceeding a target estimated P_{DCS}.[4,10] The current search algorithm has a high computational cost because hundreds of thousands of candidate schedules may be evaluated during each search (see Figure 1).[4]

The Thalmann Algorithm is a deterministic decompression algorithm in which decompression schedules are computed so that depth-dependent maximum permissible tissue compartment gas tensions (MPTTs or M-values) in a collection of compartments are not exceeded (see Appendix A for more detail). Because a single analytical solution exists for any model state, deterministic decompression algorithms are computationally inexpensive. Thalmann Algorithm parameter sets include a table defining compartment half-times and the MPTT at each decompression stop depth in each compartment. Traditionally, MPTT tables are constructed from surfacing MPTT values (sometimes referred to as M_0 values) that are defined to just allow well accepted no-stop bottom times. These surfacing values are then projected to decompression stop depths, generally as linear functions of depth.[11,12] Decompression schedules computed with candidate MPTT tables may be man-dived, and if the incidence of DCS is unacceptable the MPTT table adjusted. This process is iterated until an acceptable level of DCS results from the man-diving (see Figure 1).

Deterministic decompression algorithms developed as just described typically compute decompression schedules that have increasing P_{DCS} with increasing depth and bottom time (see for instance reference 12). To our knowledge, NEDU has produced the only deterministic decompression algorithms (Thalmann Algorithm with the XValSS-DISSUB7, XVal-He-4, and XVal-He-4B parameter sets) that compute schedules with near-uniform P_{DCS}.[4,7,13] This has been accomplished by producing a large ‘standard set’ of decompression schedules with a probabilistic decompression model with a specified target P_{DCS} and then using least squares optimization of Thalmann Algorithm parameters to fit the Thalmann Algorithm schedules to the standard set schedules (see Figure 1). A refinement of the techniques used to produce these earlier parameter sets was used in the current work.

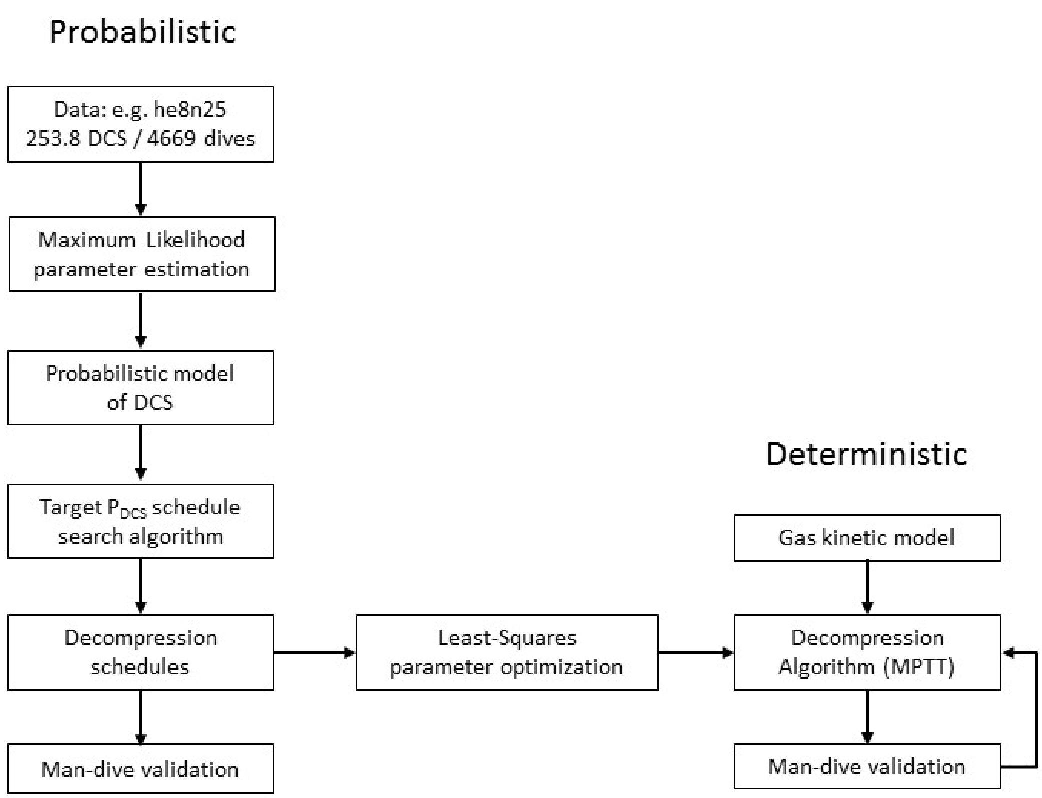

Figure 1. Deterministic decompression algorithms, probabilistic decompression models, and mapping of deterministic algorithms to probabilistic schedules (adapted from Figure 3 in reference 4).

DATA

The Thalmann Algorithm was optimized about standard sets of 6,500 dive profiles generated from a single set of 6,500 profile templates in planner coordinate format (PCF). PCF profile templates, which describe incomplete dive profiles for which decompression schedules are to be computed, serve as input for the Thalmann Algorithm and probabilistic dive planner.[5] 6,250 PCF profiles were single or repetitive square dives (bottom time spent at one depth) randomly generated according to the parameters in Table 1 using a previously developed FORTRAN tool.[4] The remaining 250 PCF templates were single multilevel profiles generated by a script written in R: A language and environment for statistical computing (R Foundation for Statistical Computing; 2017). There were 170 multilevel templates that had the bottom time spent at two depths, with the total bottom time and depths randomly selected from the ranges in Table 1. The remaining 80 multilevel templates had a 1–3 hour hold at 20 fsw breathing 1.3 atm PO_2 prior to descent to a maximum depth of 140–300 fsw for up to 120 minutes. Decompression schedules for each of the 6,500 PCF templates were then generated with the probabilistic decompression planner operating the LEM-he8n25 probabilistic model.[4,10] Separate standard sets of completed dive profiles were generated with LEM-he8n25-estimated target P_{DCS} of 2.3 %, 3 %, 3.5 %, 4 %, 4.5 %, and 5 %, although not all sets were used in the present work. Decompression stop times were computed to 1-minute resolution.

Table 1: Parameters used to randomly generate the PCF templates for the standard set.

Parameter	Value
Number of Profiles	6,500
Depths	40 – 300 fsw in 10 fsw increments
Bottom Times	5 – 240 min in 5 min increments
Descent Rate	60 fsw/min
Ascent Rate	30 – 120 fsw/min in 5 min increments
Surface Interval	15 – 720 min in 5 min increments
Maximum Number of Repetitive Dives	2

A second set of PCF profile templates was built to validate performance of the Thalmann Algorithm with candidate parameter sets on repetitive dives. This set consisted of 1,024 templates, each containing at least one repetitive dive randomly generated according to the parameters in Table 2 and Table 3. Bottom times were restricted to the longest bottom times that are assigned a repetitive group in the 1.3 atm PO_2 He-O_2 Decompression Table in *U.S. Navy Diving Manual, Revision 7*, as detailed in Table 3. The resulting PCF templates were completed with decompression schedules computed with the Thalmann Algorithm DMDB7 subroutine [5,6] and candidate parameter sets. LEM-he8n25-estimated P_{DCS} was calculated for the resulting decompression schedules.

Table 2: Parameters used to randomly generate the PCF profiles for the repetitive dive validation set.

Parameter	**Value**
Number of Profiles	1,024
Depth Range	50 – 200 fsw in 10 fsw increments
Bottom Times	See Table 3
Descent Rate	60 fsw/min
Ascent Rate	30 fsw/min
Surface Interval	5 – 720 min in 5 min increments
Maximum Number of Repetitive Dives	2

Table 3: Maximum allowable bottom times in the repetitive dive validation set

Depth (fsw)	Bottom Time	Depth (fsw)	Bottom Time
50	360	130	45
60	170	140	30
70	90	150	35
80	65	160	25
90	55	170	30
100	45	180	25
110	40	190	20
120	35	200	25

OPTIMIZATION

Optimization of Thalmann Algorithm parameters was accomplished with a modified version of a previously developed FORTRAN tool.[4] The process by which Thalmann Algorithm decompression is computed, and how the algorithm parameters can be optimized, is summarized here. We define the MPTT (M) in the i^{th} of n compartments as a function of depth (D) and a vector β_i of Ω parameters as:

$$M_{i,D} = f(\beta_i, D); [\beta_{i,1}, \dots, \beta_{i,\Omega}]. \tag{1}$$

Decompression begins by ascending to the shallowest depth at which none of the MPTTs are exceeded; i.e., the shallowest depth D_λ where the following condition is satisfied:

$$(p_i - M_{i,D_\lambda}) \leq 0, \tag{2}$$

where p_i is the inert gas tension[a] in the i^{th} compartment, D_λ is an integer multiple of the stop depth increment ($D_\lambda = \lambda \cdot DINC; \lambda = 0, 1, 2, 3, ...$), and M_{i,D_λ} is the MPTT of the i^{th} compartment at the stop depth. Ascent to each subsequent stop occurs when

$$max\left[\left(p_i - M_{i,D_{\lambda-1}}\right), i = 1,2, \dots, n\right] = 0. \quad (3)$$

Ascent continues in this fashion ascending from stop-to-stop (decrementing λ) until D_0, the surface, is reached. The compartment i that satisfies the left-hand side of equation 3 is the controlling compartment for that stop.

A parameter vector β can be found for equation (2) to produce a MPTT table that causes the Thalmann Algorithm to emulate LEM-he8n25 schedules in a particular standard set. The process entails minimizing the sum of squares error (SSE) between the standard LEM-he8n25 profiles and Thalmann Algorithm prescriptions for the same dives computed with MPTT tables from various trial βs. As in earlier work,[4] such minimizations were performed in present work using the Levenberg-Marquardt numerical optimization algorithm.[14] The scope of any resultant Thalmann Algorithm emulation is limited to the target P_{DCS} and range of profiles in the standard set against which the optimization was performed (e.g., see Table 1).

XVal-He-4 is an example of a MPTT table generated by SSE minimization in which equation (3) was modified by assuming the compartment with the greatest tissue tension at the end of a stop is the controlling compartment:[4]

$$\left(p_i - M_{i,D_{\lambda-1}}\right)\Big|_{p_{i,max}} = 0, \quad (4)$$

where $p_{i,max}$ is the maximum tissue tension at the end of stop λ. With equation (4) as the definition of the controlling compartment for stop λ, SSE for XVAL-He-4 was calculated as:

$$SSE = \sum_{\eta=1}^{N} \sum_{\delta=1}^{\Delta_\eta} \sum_{\lambda=\Lambda_{\eta,\delta}}^{1} \left(\left(p_{i,\eta,\delta,\lambda} - M_{i,D_{\lambda-1}}\right)\Big|_{p,i,\eta,\delta,\lambda}\right)^2, \quad (5)$$

[a] The Thalmann Algorithm was previously called the EL-RTA, and MPTT was defined as the maximum permissible tissue inert gas tension. Some algorithms, including Thalmann's DCM-II, have used MPTT that include other gases in addition to the inert gases.

for N dive profiles with Δ dives on each profile and Λ decompression stops. Note that Δ = 1 for the XVal-He-4 standard set, a convention that was also adopted for the standard sets in present work.

However, the compartment with the greatest end-stop tissue tension is not always the controlling compartment. This situation was accommodated in NEDU TR 02-10 by incorporating equation (3) into a definition of SSE that was not used to calculate XVal-He-4 or any of the parameter sets presented here:[4]

$$SSE = \sum_{\eta=1}^{N} \left\{ \sum_{\delta=1}^{\Delta\eta} \left\{ \sum_{\lambda=\Lambda_{\eta,\delta}}^{1} \left(max\left[\left(p_{i,\eta,\delta,\lambda} - M_{i,D_{\lambda-1}} \right), i = 1,2,\dots,n \right] \right)^2 \right\} \right\}. \tag{6}$$

This definition treats each individual decompression stop as a measurement and squares its error. In present work we treated each individual profile as a measurement by squaring the sum of the error accumulated by the decompression stops in each profile, rewriting equation (6) as:

$$SSE = \sum_{\eta=1}^{N} \left\{ \sum_{\delta=1}^{\Delta\eta} \left\{ \sum_{\lambda=\Lambda_{\eta,\delta}}^{1} \left| max\left[\left(p_{i,\eta,\delta,\lambda} - M_{i,D_{\lambda-1}} \right), i = 1,2,\dots,n \right] \right| \right\}^2 \right\}. \tag{7}$$

Equation (7) uses the more rigorous definition of the controlling compartment provided in equation (3). Because the difference between tissue tension and MPTT in equation (7) may be either positive or negative at the end of a stop, the absolute value of the maximum difference was taken to prevent differences of opposite signs from cancelling each other in the summation. Treating each profile as an observation considers that stops within a given profile are a time series of dependent events.

In accord with earlier MPTT tables developed for the Thalmann Algorithm, MPTTs were a linear function of stop depth. The specific form of the MPTT table generating function optimized in the present work was:

$$M_i = \beta_{i,0} + \beta_{i,1} D. \tag{8}$$

In addition to the table of MPTTs, Thalmann Algorithm parameter sets include several parameters that are not compartment-specific. These parameters were fixed at the values used in VVal-18 and XVal-He-4 as follows (all in fsw): PACO2 = 1.5; PVCO2 = 2.3; PVO2 = 2; PH2O = 0; AMBAO2 = 0; PBOVP = 0. PACO2 is the arterial partial pressure of carbon dioxide, PVCO2 is the venous partial pressure of carbon dioxide, PVO2 is the venous partial pressure of oxygen, PH2O is the partial pressure of water vapor, AMBAO2 is the ambient-arterial oxygen gradient, and PBOVP is a threshold for linear gas washout.

DETERMINATION OF COMPARTMENT HALF-TIMES

A principal shortcoming of the earlier method used to produce the XVal-He-4 and XValSS-DISSUB7 parameter sets is that it used a fixed set of nine compartments with blood:tissue gas exchange half-times equal to the empirical half-times of earlier Thalmann Algorithm parameter sets. It was found in the present work that emulation of LEM-he8n25 probabilistic schedules to 300 fsw requires half-times not included in these earlier parameter sets, and can be accomplished with fewer than nine compartments. The superfluous compartments from these earlier parameter sets become nuisance parameters that can produce undesirable behavior. In the present work, three approaches were tried to select the appropriate number of compartments with the appropriate half-times. Two approaches to using the mapping software to fit compartment half-times to the training data sets were tried unsuccessfully. One approach was to treat the half-times as fitted parameters and the other approach was to fit multiple compartments with a range of half-times. Because neither approach resulted in good fits to the standard sets, these approaches were abandoned in favor of choosing compartment half-times guided by inspection of characteristic decompression stop times in exploratory decompression tables computed with LEM-he8n35 with the same target P_{DCS} values used to compute the standard sets. The exploratory decompression tables were calculated with LEM-he8n25 for depths from 80 to 300 fsw in 10-fsw increments, for bottom times from 10 to 240 minutes in 10-minute increments at each depth, and without travel time in decompression stop times. Excerpts of these tables appear in the results section. Inspection of the schedules in these tables reveals three characteristic decompression stop times. The deepest stops are about 2–3 minutes in duration and the intermediate stops are about 10–11 minutes in duration, irrespective of the target P_{DCS}. Shallow stops at 30 fsw and deeper are about 80–95 minutes in duration, depending on the target P_{DCS}. The longest of 20 fsw last stops are about twice the characteristic duration of shallow stops.

Figure 2 illustrates the relationship between decompression stop times (2.3 % target P_{DCS}) and the washout of inert gas from the three LEM-he8n25 compartments. The sum of inert gas partial pressures shown for each compartment in the figure consists predominantly of helium, which has compartmental gas exchange half-times of 10, 22, and 202 minutes. The short, deep stops act to limit supersaturation in the fast, 10-minute helium half-time compartment. The intermediate stops act to limit supersaturation in the intermediate, 22-minute helium half-time compartment. The fast and intermediate compartments are supersaturated, and manifest linear washout throughout the short and intermediate stops, respectively. The long, shallow stops act to limit supersaturation in the slow, 202-minute helium half-time compartment. The slow compartment is only supersaturated for the initial portion of these stops. This compartment does not manifest linear gas washout in LEM-he8n25, irrespective of the level of supersaturation.

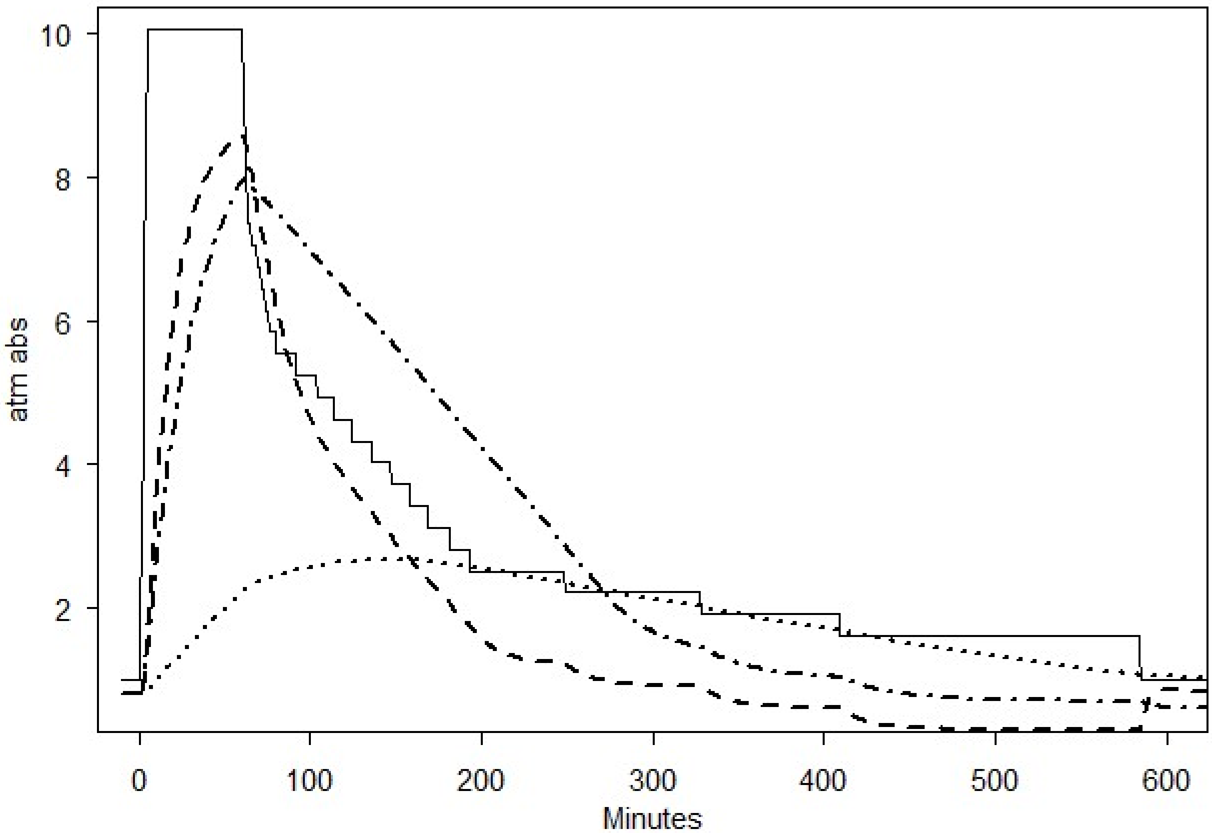

Figure 2. LEM-he8n25-modelled inert gas uptake and washout during a 300 fsw for 60-minute bottom time 1.3 atm constant PO_2 $He\text{-}O_2$ decompression schedule as given in Table 4. The solid line is the ambient pressure. The broken lines are the sums of inert gas partial pressures (as they would be if the all gas were in solution) in each of the three compartments in LEM-he8n25. For the fast half-time (dashed) and slow half-time (dotted) compartments the inert gases are helium and nitrogen. In the intermediate half-time compartment (dot-dash) the "inert" gases are helium, nitrogen, and any component of inspired oxygen partial pressures (P_IO_2) above 0.91 atm (positive values of P_IO_2-0.91 atm). Except for this latter contribution of oxygen. compartmental oxygen, carbon dioxide, and water vapor partial pressures are zero in LEM-he8n25.

The Thalmann Algorithm has exponential-linear kinetics that manifest in a similar fashion to those illustrated for LEM-he8n25 in Figure 2. With constant inspired PO_2 and linear gas washout, the Thalmann Algorithm produces decompression stop times that are dependent on the controlling compartment half-time, and are independent of depth. This relationship was used to guide the selection of Thalmann Algorithm half-times that would produce the characteristic stop times of the LEM-he8n25 decompression schedules.

Thalmann Algorithm gas kinetics are exponential unless:

$$P_{amb} < p_i + P_{FVG} - PBOVP \quad (9)$$

where P_{FVG} = PVO2+PVCO2+PH2O, in which case gas kinetics are linear. P_{amb} is the ambient pressure, P_{FVG} is the partial pressure of fixed venous gases (PVO2+PVCO2+PH2O). The update for tissue inert gas partial pressure over a dive profile segment with linear gas washout is:

$$p_i = p_{i.0} + [(P_{a.0} - P_{amb.0} + P_{FVG} - PBOVP) \times t + (R_a - R_{amb}) \times t^2/2] \times ln2/HT \quad (10)$$

where $p_{i.o}$, $P_{a.0}$, and $P_{amb.0}$ are the tissue inert gas pressure, arterial inert gas pressure, and ambient pressure at the beginning of the segment, t is duration of the segment, HT is half-lime, and R_a and R_{amb} are the rates of change in arterial inert gas pressure and ambient pressure during the segment. For an isobaric segment such as a decompression stop, P_a and P_{amb} are constant, and R_a and R_{amb} are zero so that the second term inside the square brackets disappears. Solving the isobaric update equation for HT gives:

$$HT = \frac{(P_a - P_{amb} + P_{FVG} - PBOVP)}{p_i - p_{i.0}} \times ln(2) \times t \quad (11)$$

For most decompression stops, $p_i - p_{i.o}$ is approximately $-\beta_1 \times DINC$, where β_1 is the slope of the MPTT generating function (commonly β_1 = 1) and $DINC$ is the stop depth increment (in this work $DINC$ = 10 fsw). For the first stop controlled by a particular compartment, $p_i - p_{i.o}$ may be less than $-\beta_1 \times DINC$. Using Thalmann Algorithm conventions and the blood parameters specified in the methods (page 7), the arterial PO_2 for constant 1.3 atm inspired PO_2 is:

$$P_{AO_2} = P_{IO_2} \times (1 - PH2O/P_{amb}) = 1.3\ atm \times 33 \frac{fsw}{atm} \times (1 - 0/P_{amb}) = 42.9\ fsw \quad (12)$$

and the arterial inert gas partial pressure is:

$$P_a = P_{amb} - \left(P_{AO_2} + PACO2 + PH2O\right) = P_{amb} - (42.9\ fsw + 1.5\ fsw + 0\ fsw) \quad (13)$$

Substituting into the HT equation

$$HT = \frac{(P_{amb} - 44.4\ fsw - P_{amb} + 4.3\ fsw - 0)}{-\beta_1 \times DINC} \times ln(2) \times t$$
$$= \frac{40.1}{\beta_1 \times 10} \times ln(2) \times t \qquad (14)$$

Equation (14) was used with characteristic stop times of LEM-he8n25 schedules, t, to guide selection of Thalmann Algorithm half-times.

RESULTS

TARGET P_{DCS} 2.3 % PARAMETER SETS

Table 4 is an excerpt of the exploratory table of LEM-he8n25 2.3 % target P_{DCS} 1.3 atm PO_2 He-O_2 schedules. Inspection of these schedules reveals the three characteristic decompression stop durations: short, deep stops of 2–3 minutes duration; intermediate stops of 10–11 minutes duration; and the long shallow stops of about 80 minutes duration (median of stops 70 minutes or longer and 30 fsw or deeper). The longest 20 fsw last stops are about twice the characteristic duration of shallow stops.

In all Thalmann Algorithm fits to the 2.3 % P_{DCS} standard set β_1 was fixed equal to one. Table 5 shows some pairs of Thalmann Algorithm half-times and decompression stop times calculated for 1.3 atm PO_2, linear gas washout, β_1 = 1, and $DINC$ = 10 using equation (14). These conditions and parameters are used in the following development unless otherwise noted. Parameter sets in which the fastest half-time had values of 6 to 10 minutes produced similar fits to the standard set. A Thalmann Algorithm MPTT table with a 10-minute half-time was selected for the fastest compartment, the same as the fastest helium half-time in LEM-he8n25.

A Thalmann Algorithm half-time of about 30 minutes will produce decompression stop times of 10–11 minutes. However, MPTT tables arising from fit of a 30-minute half-time to the standard set resulted in poor emulation of LEM-he8n25 decompression schedules for dives with bottom times longer than about 110 minutes. Such Thalmann Algorithm schedules had 11-minute stops starting deeper than in the corresponding LEM-he8n25 schedules. In Table 4, for the 300 fsw schedules, the dotted line indicates that the depth of the first 11-minute stop increases with increasing bottom time until a bottom time of 110 minutes and there is no further increase in depth of the first 11-minute stop for longer bottom times. A similar pattern is evident for the 200 fsw schedules, and the pattern is repeated for all bottom depths (not shown). However, in Thalmann Algorithm schedules calculated with a 30-minute half-time, the depth of the first 11-minute stop increased with bottom time longer than 110 minutes. The LEM-he8n25 behavior could be emulated by manipulating the Thalmann Algorithm compartment Saturation / Desaturation Ratio (SDR) parameter. Setting the SDR to a value other than one causes compartment gas uptake (saturation) and gas washout (desaturation) to occur with different half-times. An intermediate compartment with half-time of 20 minutes (gas uptake) with SDR = 0.67 was found to emulate the LEM-he8n25 behavior. With a 20-minute half-time for gas uptake, near-equilibrium with inspired gas is reached at about 120 minutes of bottom time (6 half-times), and there is little change in the decompression stops governed by such a compartment with longer bottom times. With a 20-minute half-time and SDR = 0.67, gas washout occurs with approximately a 30-minute half-time and produces 11-minute stops.

Table 4. Excerpt of LEM-he8n25 2.3 % P_{DCS} 1.3 atm PO_2 He-O_2 exploratory table

BT	DECOMPRESSION STOPS (fsw) Stop times do not include travel time																				
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
200 fsw																					
10																				1	2
20																1	2	2	3	2	18
30														2	2	2	3	2	2	9	68
40												1	2	2	2	2	3	8	11	12	102
50												2	2	3	2	3	11	11	11	12	134
60											1	2	2	2	4	11	11	11	11	11	166
70											1	3	2	2	10	11	12	11	11	36	170
80											2	2	2	6	11	11	11	12	11	62	172
90											2	3	2	9	11	10	11	12	18	84	170
100											2	2	3	11	11	11	11	11	42	81	175
110											2	2	5	11	11	10	11	11	66	82	174
120											2	2	6	11	11	11	10	21	79	81	176
130											2	2	7	11	11	10	11	43	80	81	175
140											2	2	8	11	10	11	12	63	79	82	176
150											2	2	8	11	11	10	11	83	79	81	180
160											2	2	8	11	11	11	28	87	79	81	179
170											2	2	8	11	11	11	51	83	78	81	181
180											2	2	8	11	11	11	76	77	79	80	182
300 fsw																					
10																2	2	2	3	2	8
20											5	2	2	3	2	2	2	7	12	12	95
30							5	2	2	2	2	3	3	3	12	11	11	11	11	13	167
40				3	2	2	3	2	2	2	4	11	11	11	11	11	11	11	12	77	172
50		1	2	2	2	3	2	2	6	12	11	10	11	12	11	10	10	11	69	81	175
60		2	3	2	2	2	4	11	12	10	10	11	11	11	10	12	12	55	79	81	175
70	1	2	2	2	3	6	11	11	10	11	11	11	10	11	10	11	28	85	79	81	180
80	1	2	3	2	5	11	11	11	11	10	11	10	11	11	10	11	78	77	79	81	182
90	2	2	2	3	12	9	11	11	10	11	11	10	11	10	11	28	97	78	79	81	184
100	2	2	2	7	11	11	11	10	11	10	11	10	11	10	11	77	84	77	79	82	185
110	2	2	2	10	11	11	10	11	10	11	11	10	10	11	18	108	76	77	79	82	188
120	2	2	4	10	11	11	10	11	10	11	11	10	11	10	59	97	76	78	79	81	190
130	2	2	5	11	10	11	11	10	11	10	11	10	11	11	101	83	76	78	80	81	191
140	2	2	6	11	10	11	11	10	11	10	11	11	11	42	108	75	76	78	80	81	190
150	2	2	7	11	10	11	11	10	10	11	10	11	11	77	97	75	77	78	80	82	192
160	2	2	7	11	11	10	11	11	10	10	11	11	18	109	83	75	77	78	80	82	194
170	2	3	7	10	11	10	11	11	10	11	10	11	50	112	74	75	77	79	80	82	194
180	2	2	8	11	10	11	11	10	10	11	11	10	88	98	74	76	77	79	79	83	195

Table 5. Thalmann Algorithm half-times and characteristic decompression stop times for 1.3 atm PO_2, linear gas washout, β_1=1, and $DINC$=10.

Stop Time	Half-Time
2	6
3	8
4	11
7	20
10	28
11	31
80	222

To produce decompression stops of about 80 minutes duration requires a half-time in the vicinity of 200 minutes. As is evident in Figure 2, during these shallow stops the inert gas partial pressure in a compartment with such a half-time will mostly be lower than ambient pressure, and as a result gas washout will mostly be exponential in the Thalmann Algorithm with PBOVP = 0. With exponential gas washout, the relationship between half-time and stop duration is depth-dependent, so it was not possible to select a unique half-time a priori. By trial and error, a 210 minute half-time was found to produce the best fit to the 2.3 % P_{DCS} standard set and produce good Thalmann Algorithm tables.

Table 6. XVal-He-8_023 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[210]
SDR	[1]	[0.67]	[1]
β_0 (atm)	1.693	2.202	0.731
M_0 (fsw)	66.016	82.825	34.165
β_1	[1]	[1]	[1]

Table 6 shows the MPTT generating parameters arising from fit of the Thalmann Algorithm to the 2.3 % P_{DCS} standard set. MPTT tables generated from these parameters are designated XVal-He-8_023, with digits after the underscore representing the target P_{DCS} of the standard set. The half-times, SDR, and β_1 were fixed and the β_0 were fitted. The M_0 values are calculated from the β_0 values.[b] The XVal-He-8_023 MPTT table is given in Appendix A. Example XVal-He-8_023 decompression schedules are given in Table 7. For comparison with the exploratory table, the example schedules are calculated without travel time in stops.

[b] Unlike the Thalmann Algorithm which uses the U.S. Navy rounded conversion factor of 33 fsw/atm, the fitting software uses the conversion factor 33.078 fsw/atm, and this factor was used to calculate M_0 values in fsw from the β_0 values.

Table 7. XVal-He8_023 and XVal-He-9_023 Thalmann Algorithm 1.3 atm PO_2 He-O_2 schedules (300 fsw)

BT	DECOMPRESSION STOPS (fsw) Stop times do not include travel time																				
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
XVal-He-8_023 300 fsw																					
10														1	3	3	4	3	3	3	10
20								2	3	3	4	3	3	3	4	3	3	3	11	10	112
30					4	3	3	3	4	3	3	3	4	3	8	11	10	11	10	17	177
40			3	3	4	3	3	3	4	3	3	8	10	11	10	10	11	10	17	77	178
50		3	3	4	3	3	3	4	3	9	11	10	11	10	10	11	10	11	76	77	178
60	1	4	3	3	3	4	3	9	10	11	10	10	11	10	11	10	10	65	77	78	177
70	2	3	4	3	3	5	10	10	11	10	11	10	10	11	10	11	47	77	77	78	177
80	3	3	3	3	5	10	11	10	10	11	10	11	10	11	10	24	78	77	77	78	177
90	3	3	3	4	9	11	10	11	10	10	11	10	11	10	10	65	77	78	77	77	178
100	3	3	3	7	10	11	10	10	11	10	11	10	10	11	35	78	77	77	78	77	178
110	3	3	4	9	10	10	11	10	11	10	10	11	10	11	69	78	77	78	77	77	178
120	3	3	4	10	11	10	11	10	10	11	10	11	10	36	78	77	78	77	77	78	177
130	3	3	5	11	10	11	10	10	11	10	11	10	11	67	77	78	77	78	77	77	178
140	3	3	6	11	10	11	10	10	11	10	11	10	32	77	78	77	77	78	77	78	177
150	3	3	7	11	10	10	11	10	11	10	10	11	61	77	78	77	78	77	77	78	177
160	3	3	8	10	10	11	10	11	10	10	11	23	77	78	77	78	77	77	78	77	178
170	3	3	8	10	11	10	11	10	10	11	10	51	78	77	78	77	77	78	77	78	177
180	3	3	8	11	10	10	11	10	11	10	11	78	77	77	78	77	77	78	77	78	177
XVal-He-9_023 300 fsw																					
10																1	3	3	3	4	6
20										2	3	3	3	4	3	3	3	7	10	11	97
30							3	4	3	3	3	4	3	5	10	11	10	10	11	10	171
40					3	3	3	4	3	3	6	11	10	10	11	10	11	10	10	73	177
50				3	3	3	4	3	9	10	11	10	11	10	10	11	10	11	68	78	177
60			1	3	4	3	8	11	10	10	11	10	11	10	10	11	10	59	77	78	177
70			2	3	4	10	11	10	11	10	10	11	10	11	10	10	42	78	77	78	177
80		1	3	4	9	10	10	11	10	11	10	11	10	10	11	21	77	78	77	77	178
90		3	3	6	10	11	10	10	11	10	11	10	10	11	10	63	77	78	77	77	178
100	1	3	3	9	10	10	11	10	11	10	10	11	10	11	34	77	78	77	77	78	177
110	2	3	3	10	11	10	11	10	10	11	10	11	10	10	69	78	77	77	78	77	178
120	2	4	4	10	11	10	10	11	10	11	10	11	10	36	77	78	77	78	77	77	178
130	3	3	5	11	10	10	11	10	11	10	11	10	10	68	77	78	77	77	78	77	178
140	3	3	6	11	10	10	11	10	11	10	10	11	32	77	77	78	77	77	78	77	178
150	3	4	6	10	11	10	11	10	10	11	10	11	61	77	78	77	77	78	77	77	178
160	3	4	6	11	10	11	10	10	11	10	11	23	77	78	77	77	78	77	78	77	177
170	4	3	7	10	11	10	10	11	10	11	10	52	77	77	78	77	78	77	77	78	177
180	4	3	7	10	11	10	11	10	10	11	11	77	78	77	78	77	77	78	77	78	177

Although XVal-He-8_023 emulates LEM-he8n25 target 2.3 % P_{DCS} decompression schedules well, the no-stop limits for depths of 90 fsw and deeper are shorter than the corresponding no-stop limits that appear in the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual* (see Table 8). From 35 fsw to 200 fsw, the no-stop limits are calculated directly to the nearest minute using the XVal-He-4 Thalmann Algorithm[c] and the results of man-testing of no-stop limits for depths of 120–200 fsw indicates that the XVal-He-4 Thalmann Algorithm no-stop limits in this range are of appropriate duration (Table 8).[4,15] Therefore, it was desirable to produce a MPTT table that would replicate these no-stop limits.

Table 8. No-stop limits and man testing for 1.3 atm PO_2 He-O_2 diving

fsw	Dive Man. min	XVal-He-8_023 min	XVal-He-9_023 min	tested min (DCS/dives)*		
30†	332	359	359			
35†	190	216	216			
40	unlimited	unlimited	unlimited			
50	325	352	352			
60	134	155	155			
70	86	101	101			
80	63	75	75	110 (0/7)	130 (0/24)	
90	44	27	46			
100	31	18	32			
110	24	14	25			
120	20	11	21	20 (2.2/29)	27 (1.2/24)	30 (0/16)
130	17	10	18			
140	15	8	15			
150	13	7	13			
160	12	6	11	13 (1.2/24)	16 (0/16)	18 (1/4)
170	11	6	10			
180	10	5	9			
190	9	5	8			
200	8	4	7	9 (0/16)	10 (1.3/16)	11 (2/24)
210	5	4	7			
220	5	-‡	6			
230	5	-‡	6			
240	5	-‡	5			
250	5	-‡	5			
260	5	-‡	-‡			

*Fractional DCS represent marginal DCS cases, each assigned a value of 0.1; †No-stop limits calculated for 0.7 atm PO_2; ‡No-stop limit shorter than descent time.

[c] In the 1.3 atm PO_2 He-O_2 Decompression Tables, the no-stop limits for depths deeper than 200 fsw are not directly calculated. At these depths, decompression schedules were calculated with LEM-he8n25 with 2.3 % target P_{DCS} for bottom times in 5-minute increments, and the tabulated no-stop limit is the longest of these bottom times not requiring decompression stops.

A new set of MPTT generating parameters, designated XVal-He-9_023, was produced by modifying XVal-He-8_023 based on the following observations. Table 9 gives the 1.3 atm PO_2 $He-O_2$ no-stop limits that appear in the *U.S. Navy Diving Manual* and the inert gas tension in various Thalmann Algorithm compartments on reaching surface after no-stop dives to these limits. For no-stop dives of 90 fsw and deeper, the surfacing inert gas tensions in the 10-minute half-time compartment in Table 9 are substantially higher than the XVal-He-8_023 M_0 of 66.016 fsw. An XVal-He-9_023 10-minute half-time compartment with a M_0 in the vicinity of the surfacing values shown in Table 9 is necessary. By trial and error, a M_0 of 85 fsw was found to be the smallest value that did not result in no-stop limits substantially shorter than XVal-He-4, but this change to the 10-minute half-time compartment did not itself reproduce the XVal-He-4 no-stop limits. The XVal-He-4 Thalmann Algorithm no-stop limits for 90 fsw and deeper are governed by the 20-minute half-time compartment and its M_0 of 64.879. However, a compartment with these parameters produced schedules with undesirable 7-minute stops where the exploratory table had short, deep stops. Instead, a compartment with a 20-minute half-time and SDR of 2 (so that gas washed out with a 10-minute half-time) was added to XVal-He-9_023. By trial and error, an M_0 of 64 fsw for this compartment was found to closely reproduce the XVal-He-4 no-stop limits and, except for dives with short bottom times, to replace the short, deep decompression stops that would otherwise be lost because of the higher M_0 for the 10-minute compartment compared to XVal-He-8_023.

So that XVal-He-9_023 could support calculation of repetitive group designators consistent with those in the 1.3 atm PO_2 $He-O_2$ Decompression Tables of the *U.S. Navy Diving Manual*, a 120-minute half-time reference compartment was added with the XVal-He-4 M_0 of 41.731 fsw. Repetitive groups designators represent ranges of inert gas tensions in the reference compartment between its M_0 and 24.57 fsw. The compartment was assigned a $\beta_1 = 2$ so that its MPTTs would increase rapidly with depth ensuring that this compartment would not control any decompression stops.

Table 10 gives the XVal-He-9_023 MPTT generating function. Note that XVal-He-9_023 retains the same 20-minute compartment with SDR 0.67, with the M_0 for the 20-minute compartment rounded to 83 fsw, and 210-minute half-time compartment as XVal-He-8_023. The complete XVal-He-9_023 MPTT table is given in Appendix A.

Example XVal-He-9_023 decompression schedules are given in Table 7. Complete tables of XVal-He-9_023 Thalmann Algorithm decompression schedules with dive depths in fsw and msw and bottom times corresponding to the1.3 atm PO_2 $He-O_2$ Decompression Tables of the *U.S. Navy Diving Manual* are given in Appendix B and Appendix C. The tables in the appendices are calculated with the same conventions used for the 1.3 atm PO_2 $He-O_2$ Decompression Tables of the *U.S. Navy Diving Manual* since Revision 6: repetitive group designators are suppressed for increasing bottom time from the first bottom time with a repetitive group designator lower than the preceding bottom time[16], and, unlike the exploratory tables and example schedules in the body of the report, travel time between decompression stops is included in decompression stop time.[17]

Table 9. Compartment gas tensions on reaching surface after dives to the 1.3 atm PO_2 He-O_2 no-stop limits in the *U.S. Navy Diving Manual*.

No-stop limits fsw	min	Half-Time SDR	10 1	20 1	20 0.67	20 2	210 1
30*	332		38	38	38	38	34
35*	190		43	43	43	42	33
50	325		37	38	38	37	34
60	134		46	47	47	46	33
70	86		55	55	56	53	33
80	63		63	61	62	59	33
90	44		71	64	65	62	32
100	31		75	64	65	62	31
110	24		78	63	64	61	30
120	20		80	63	64	61	30
130	17		81	63	64	61	30
140	15		83	63	64	61	30
150	13		83	63	64	60	29
160	12		85	64	64	61	29
170	11		86	64	65	62	29
180	10		87	64	65	62	29
190	9		86	63	64	61	29
200	8		85	62	63	60	29
210	5		70	52	53	50	28
220	5		73	54	55	52	28
230	5		76	56	57	54	28
240	5		79	58	59	56	29
250	5		82	60	61	58	29
260	5		85	62	63	60	29

*No-stop limits and gas tensions calculated for 0.7 atm PO_2

Table 10. XVal-He-9_023 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[20]	[120]	[210]
SDR	[1]	[2]	[0.67]	[1]	[1]
β_0 (atm)	-	-	-	-	[0.731]
M_0 (fsw)	[85]	[64]	[83]	[41.731]	[34.165]
β_1	[1]	[1]	[1]	[2]	[1]

Figure 3 illustrates the LEM-he8n25-estimated P_{DCS} of XVal-He-9_023 Thalmann Algorithm schedules for most depth and bottom time combinations that appear in the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual, Revision 7* (most no-stop schedules and all schedules for depths deeper than 300 fsw are not illustrated). The P_{DCS} of all schedules are given in Appendix B and P_{DCS} for msw schedules are tabulated in Appendix C. The estimated P_{DCS} of corresponding XVal-He-4B Thalmann Algorithm schedules are also shown in Figure 3, these illustrate that XVal-He-9_023 corrects the shortcomings of XVal-He-4B that produced high-P_{DCS} schedules for dive depth deeper than 200 fsw.

Figure 4A compares the TST for XVal-He-9_023 Thalmann Algorithm schedules and the optimum (shortest) TST of LEM-he8n25 2.3 % target P_{DCS} schedules. Most schedules fall near the identity line, indicating that XVal-He-9_023 Thalmann Algorithm schedules have similar TST to corresponding LEM-he8n25 2.3 % target P_{DCS} schedules. Together, Figure 3 and Figure 4A illustrate that XVal-He-9_023 Thalmann Algorithm produces decompression schedules with near-uniform 2.3 % P_{DCS} and near-optimum TST. The XVal-He-9_023 Thalmann Algorithm emulation of LEM-he8n25 2.3 % target P_{DCS} schedules is good for more depth-bottom times combinations than illustrated in Figure 3 and Figure 4A, with good emulation of the entire 240-minute bottom time range of the LEM-he8n25 2.3 % target P_{DCS} exploratory table.

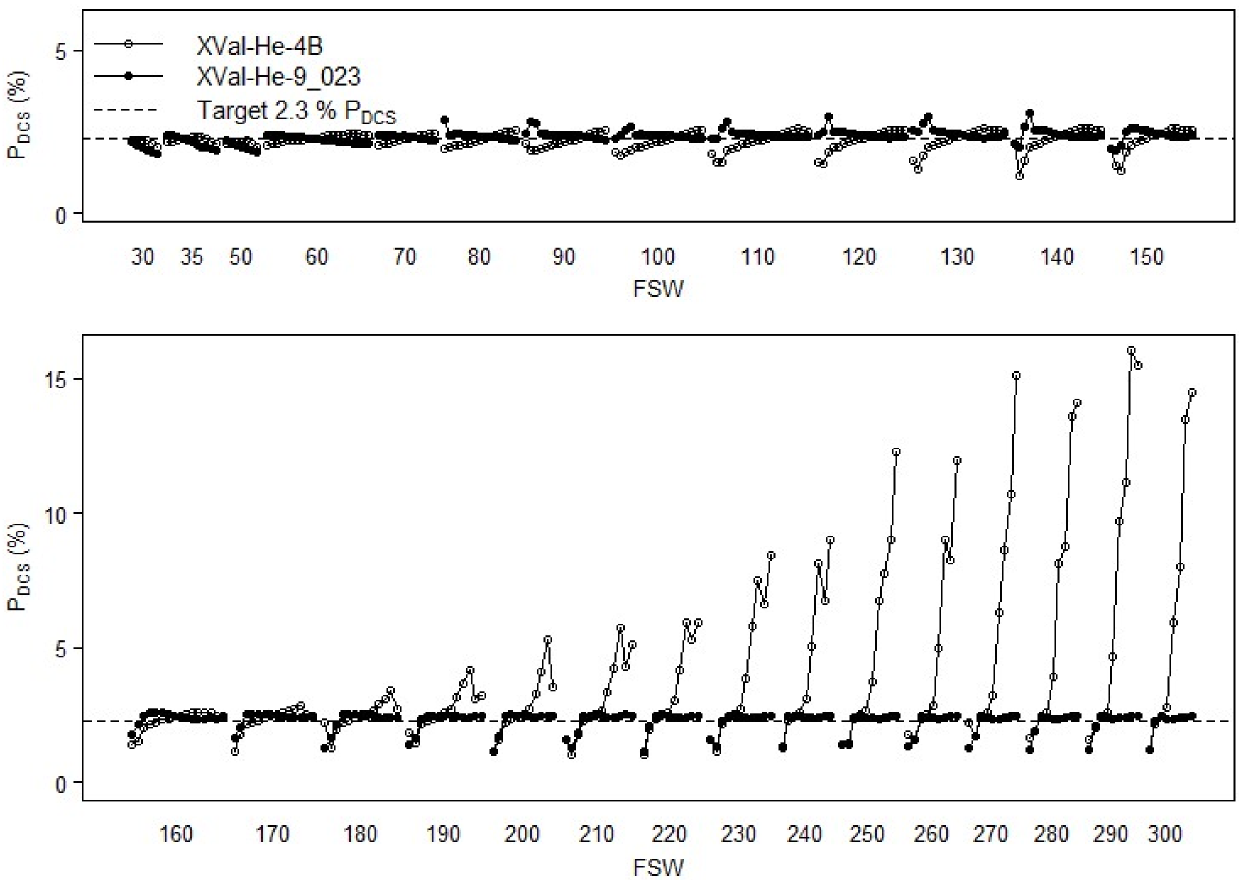

Figure 3. P_{DCS} of XVal-He-9_023 (solid points) and corresponding XVal-He-4B (open points) decompression schedules. Each point indicates a depth and bottom time combination. Depth groups are indicated on the x-axis. Within each depth group bottom times increase from left to right, from near the no-stop limit up to the maximum bottom time in the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual, Revision 7*. Most corresponding XVal-He-9_023 and XVal-He-4B no-stop limits differ slightly (see Table 8), and to facilitate aligning the traces, these and any intervening bottom times are omitted.

Figure 4B compares the TST for XVal-He-9_023 and XVal-He-4B Thalmann Algorithm schedules for depths of 200 fsw or less, the operational range of the latter parameter set. XVal-He-4B Thalmann Algorithm produces schedules that are either identical (for depths of 180 fsw or less) or similar (for depths of 190 fsw and 200 fsw) to the XVal-He-4 schedules in the 1.3 atm PO_2 He-O_2 Decompression Tables.[7]

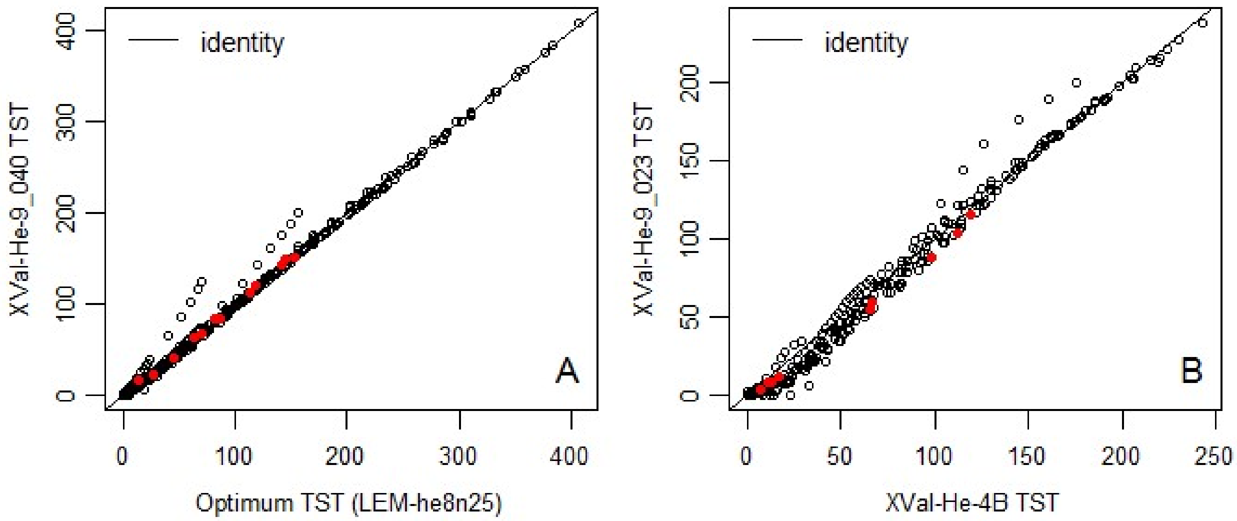

Figure 4. Panel A. Comparison of TST for XVal-He-9_023 Thalmann Algorithm and LEM-he8n25 schedules. Each point indicates a depth-bottom time combination in the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual, Revision 7*. Red, filled points indicate single dive (not part of a repetitive series) LEM-he8n25 schedules man-tested.[4] The few points separated from the cluster of points along the identity line are for bottom times of 6–12 hours at 30 and 35 fsw, depths for which schedules are calculated for 0.7 atm PO_2 He-O_2. Panel B. Comparison of TST for XVal-He-9_023 Thalmann Algorithm and XVal-He-4B Thalmann Algorithm. Each point indicates a depth-bottom time combination in the 1.3 atm PO_2 He-O_2 Decompression Tables for depths of 200 fsw and shallower. Red, filled points indicate single dive (not part of a repetitive series) XVal-He-4 Thalmann Algorithm schedules that have been man-tested.[4]

Figure 5 illustrates LEM-he8n25-estimated conditional P_{DCS} of first and repetitive dives computed using XVal-He-9_023 Thalmann Algorithm with the repetitive diving validation PCF set. For calculation of conditional P_{DCS} for repetitive dives, the LEM-he8n25 model state is calculated for the entire repetitive dive profile, but P_{DCS} is reset to zero at the end of each surface interval. Schedules were computed either in table mode or algorithm mode. In table mode the repetitive dive equivalent single dive time is calculated from the repetitive group of the preceding dive and the residual helium timetable, and the decompression schedule is for a tabulated bottom time closest to but not less than the equivalent single dive time. The table mode approximations generally result in conservative decompression schedules and in conditional P_{DCS} being centered around a lower value than the target 2.3% (Figure 5, left panel). Some of repetitive dives represented in Figure 5 may not be allowed by using the 1.3 atm PO_2 He-O_2 Decompression Tables and associated rules. First, the software for calculating repetitive schedules (DMDB7) does not suppress repetitive groups in the same manner as in tables. Second, some repetitive profiles may include three decompression dives whereas only two decompression dives are allowed. In algorithm mode the repetitive schedules are calculated exactly for the surface intervals and bottom times in the input PCF profiles, such as would occur with an NDC. Consequently the conditional P_{DCS} are centered around the target 2.3% (Figure 5, right panel). For both modes, the maximum conditional P_{DCS} of any repetitive dive is about 3.3 %.

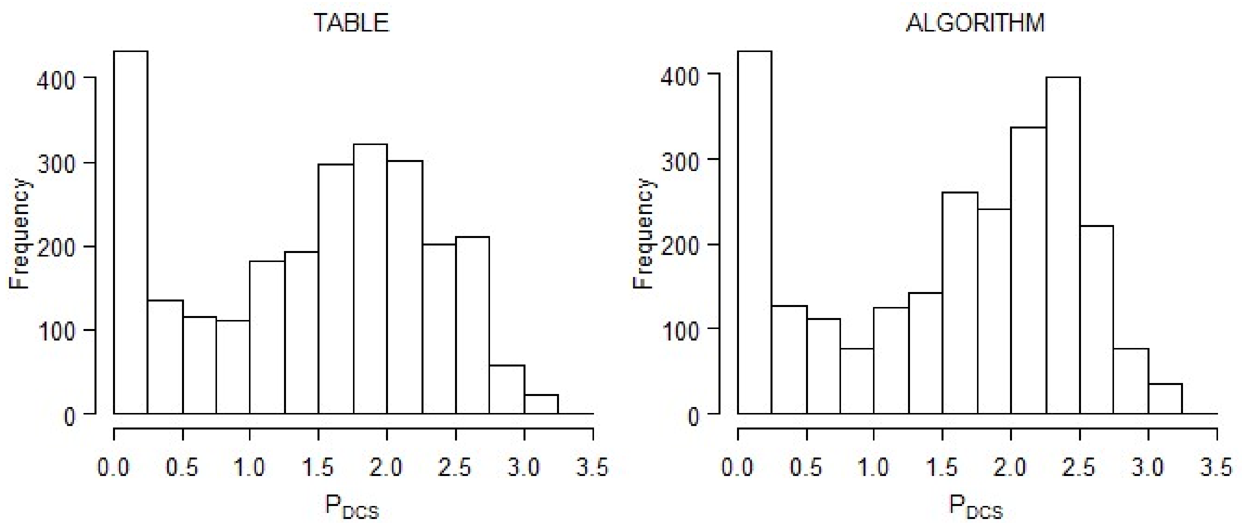

Figure 5. Conditional P_{DCS} of individual dives in repetitive dive series calculated using XVal-He-9_023 Thalmann Algorithm. Histograms are of all 2,579 first and repetitive dives in the 1,024 repetitive dive series. The left panel illustrates P_{DCS} for the repetitive dives as they would be scheduled using repetitive groups and the residual helium timetable. The right panel illustrates P_{DCS} for the dives as they would be calculated using the algorithm to follow the profile of dives and surface intervals exactly. The substantial number of dives with low conditional P_{DCS} are for depth-bottom time combinations shorter than the no-stop limits.

TARGET P_{DCS} 4 % AND 5 % PARAMETER SETS

Table 11 shows excerpts of the exploratory tables of LEM-he8n25 schedules with target P_{DCS} of 2.3 %, 4 %, and 5 %. Inspection of these schedules reveals that depths of onset and characteristic durations of the short, deep (2–3 minutes) stops and the intermediate 10–11 minute) stops are the same for corresponding schedules with different target P_{DCS}. Based on this observation, compartments with fixed 10-minute half-time and 20-minute half-time with SDR 0.67 were retained for the higher P_{DCS} parameter sets. The long, shallow decompression stops are of longer duration but shallower depth of onset with increasing target P_{DCS}. These shallow stops have characteristic durations of 86 minutes for 4 % P_{DCS} schedules and 94 minutes for 5 % P_{DCS} schedules (median of stops 70 minutes or longer and 30 fsw or deeper from exploratory tables). Additionally, the 20 fsw last stops are slightly shorter with increasing target P_{DCS}. These different characteristics of the long, shallow stops could not be achieved by manipulating the compartment half-time alone, but could be emulated by using a value of β_1 greater than one, and in fit of the Thalmann Algorithm to the higher P_{DCS} standard sets, β_1 for the slowest compartment was a fitted parameter. By trial and error, slow compartments with half-times fixed at 200 minutes and 190 minutes were found to produce the best results for the 4 % P_{DCS} and 5 % P_{DCS} standard sets respectively.

Table 11. Excerpts of LEM-he8n25 2.3 %, 4 %, and 5 % P_{DCS} 1.3 atm PO_2 He-O_2 exploratory tables

BT (min)	DECOMPRESSION STOPS (fsw) Stop times do not include travel time 220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
290 fsw 2.3 % P_{DCS}																					
10																1	2	2	2	3	6
20											3	3	2	2	3	2	2	3	12	11	88
30							2	3	2	2	3	2	2	3	8	11	12	11	11	12	155
40					3	2	2	3	2	2	2	7	11	12	11	11	11	10	11	61	173
50			1	3	1	3	2	2	3	8	11	11	12	10	11	10	11	12	50	81	174
60			2	3	2	2	2	6	11	11	11	10	11	11	11	10	12	34	79	81	175
70		1	2	2	2	3	8	10	11	11	11	10	12	9	11	12	11	78	79	81	179
80		1	2	3	2	6	11	11	11	11	10	11	11	10	11	11	46	83	79	81	181
90		2	2	2	4	10	11	11	10	11	11	10	11	10	11	11	90	77	79	82	181
100		2	2	2	8	10	11	11	11	10	11	10	11	11	10	40	93	78	79	81	185
110		2	2	2	10	11	11	11	10	11	11	10	10	11	11	83	82	78	79	81	185
120		2	2	4	11	10	11	11	10	11	10	11	10	11	23	106	76	78	79	81	187
130		2	2	5	11	11	10	11	10	11	10	11	11	10	63	95	76	78	79	82	188
140		2	2	6	11	11	10	11	10	11	10	11	11	10	102	82	76	79	79	81	190
150		2	2	7	11	10	11	10	11	11	10	11	10	36	110	75	76	78	79	82	192
290 fsw 4 % P_{DCS}																					
10																	1	4	2	2	2
20												3	4	3	2	2	2	4	11	12	42
30								2	5	2	2	3	2	2	9	11	11	12	11	11	110
40						4	3	2	2	2	3	7	11	12	11	10	11	11	11	41	145
50				2	3	2	2	3	2	9	11	11	11	11	11	10	11	11	12	96	147
60			2	2	3	2	2	5	12	11	10	11	11	11	11	10	11	12	55	99	152
70			3	2	2	2	8	11	12	10	11	10	11	10	11	11	11	10	109	87	156
80		1	2	2	3	6	11	11	11	11	10	11	11	10	11	10	11	48	116	79	160
90		1	3	2	3	11	11	11	11	10	11	10	11	10	11	11	11	90	105	79	164
100		1	3	2	7	11	12	10	10	12	10	10	11	10	11	12	35	110	93	79	165
110		2	2	2	10	11	11	11	10	11	10	11	10	11	12	10	68	114	84	79	168
120		2	2	4	10	11	12	10	10	11	10	11	10	11	11	15	98	112	77	80	171
130		2	2	5	11	11	10	12	10	10	11	10	11	11	10	45	104	102	78	80	172
140		2	2	6	11	11	10	11	10	11	10	11	11	11	10	73	108	92	78	80	176
150		2	2	7	11	10	11	10	11	11	10	11	10	11	19	93	113	82	78	81	177
290 fsw 5 % P_{DCS}																					
10																	1	4	2	2	1
20												1	4	4	3	2	3	3	12	11	22
30									3	5	3	2	2	3	9	11	11	12	11	11	87
40							3	6	2	2	3	7	12	11	11	11	10	11	11	11	151
50					3	4	2	2	3	9	11	11	11	11	10	11	11	12	11	71	147
60				4	2	2	3	5	12	11	10	11	11	11	10	11	11	12	19	120	140
70			2	3	2	2	8	11	11	11	10	11	11	11	10	12	11	10	68	113	143
80		1	2	2	2	7	11	12	10	11	10	11	10	11	12	9	11	16	107	102	149
90		1	3	1	4	11	11	11	10	11	11	10	11	10	11	11	12	52	112	93	150
100		1	2	3	7	11	11	11	10	11	11	10	11	11	10	11	11	86	117	82	155
110		1	3	2	10	11	11	11	10	11	10	11	10	11	11	11	30	99	114	79	158
120		1	3	4	10	11	11	10	12	10	11	10	10	11	11	11	60	102	106	79	161
130		2	2	5	11	11	10	11	10	11	10	11	11	11	11	12	90	111	92	81	159
140		2	2	6	11	11	10	12	9	12	9	11	12	9	11	34	94	111	87	80	166
150		2	2	7	11	10	11	10	11	11	10	11	11	11	11	59	95	115	79	79	168

Table 12 and Table 13 shows the MPTT generating parameters arising from fit of the Thalmann Algorithm to the 4 % and 5 % P_{DCS} standard sets. MPTT tables generated from these parameters are designated XVal-He-8_040 and XVal-He-8_050, with digits after the underscore representing the target P_{DCS} of the standard set. The half-times and SDR for all compartments, and β_1 for the fast and intermediate compartment were fixed. The β_0 for all compartments and β_1 for the slow compartment were fitted. The M_0 values are calculated from the β_0's. The XVal-He-8_040 and XVal-He-8_050 MPTT tables are given in Appendix A and example XVal-He-8_040 and XVal-He-8_050 decompression schedules are given in Table 14 and Table 15.

Table 12. XVal-He-8_040 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[200]
SDR	[1]	[0.67]	[1]
β_0 (atm)	1.839	2.213	0.798
M_0 (fsw)	70.820	83.204	38.274
β_1	[1]	[1]	1.188

Table 13. XVal-He-8_050 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[190]
SDR	[1]	[0.67]	[1]
β_0 (atm)	1.859	2.212	0.827
M_0 (fsw)	71.500	83.171	40.437
β_1	[1]	[1]	1.310

Additional sets of MPTT generating parameters, designated XVal-He-9_040 and XVal-He-9_050 (see Table 16 and Table 17), were produced that would support calculation of no stop limits for 90 fsw and deeper the same as XVal-He-9_023 and in accord with that appear in the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual*. Whereas it would be technically possible to design MPTT tables that would support computation of longer no-stop limits and accordingly with higher P_{DCS}, this was considered unwise. Even though many of XVal-He-9_023 no-stop limits — those for depths of 140 fsw and deeper — have LEM-he8n25-estimated P_{DCS} less than 2.3 %, it is possible that extending these deeper no-stop limits may result in severe DCS. This concern was based on previous man-testing of extended no-stop limits for air diving to depths of 130 fsw and deeper with estimated P_{DCS} in the vicinity of 2.3 %.[18] These dives resulted in only a 1.3 % cumulative incidence of DCS (exact 95 % confidence limits 0.5 %, 3.0 %) but all cases were unacceptably severe. XVal-He-9_040 and XVal-He-9_050 generating parameters were modified from XVal-He-9_023 (Table 10) by changing the slowest compartment parameters to those of XVal-He-8_040 and XVal-He-8_050, respectively (Table 12 and Table 13). The no-stop limits computed with the Thalmann Algorithm using XVal-He-9_023, XVal-He9_040, and XVal-He-9_050 are the same for depths of 90 fsw and deeper. Table 18 shows the different no-stop limits for depths of 80 fsw and shallower, and for comparison the no-stop limits for 1.3 atm PO_2 He-O_2 and N_2-O_2 diving in the *U.S. Navy Diving Manual.*

By retaining the 120 minute half-time compartment from XVal-He-9_023, XVal-He-9_040 and XVal-He-9_050 can support calculation of repetitive group designators consistent with those in the 1.3 atm PO_2 $He\text{-}O_2$ Decompression Tables of the *U.S. Navy Diving Manual*, However, XVal-He-9_040 and XVal-He-9_050 were developed to support extended bottom time single dives rather than repetitive diving. The XVal-He-9_040 and XVal-He-9_040 MPTT tables are given in Appendix A.

Table 14. XVal-He8_040 and XVal-He-9_040 Thalmann Algorithm 1.3 atm PO $He\text{-}O_2$ schedules (290 fsw)

BT	DECOMPRESSION STOPS (fsw) Stop times do not include travel time																				
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
XVal-He-8_040 290 fsw																					
10															1	3	3	4	3	3	7
20									1	3	4	3	3	3	4	3	3	3	7	11	58
30						2	4	3	3	3	4	3	3	3	5	10	11	10	11	10	123
40				2	3	3	4	3	3	3	4	3	10	11	10	11	10	10	11	10	183
50			1	4	3	3	4	3	3	6	10	11	10	10	11	10	11	10	10	65	183
60			3	3	4	3	3	4	11	10	11	10	10	11	10	11	10	10	39	86	182
70		1	3	3	3	4	6	11	10	10	11	10	11	10	11	10	10	11	83	85	183
80		1	3	3	4	6	11	10	10	11	10	11	10	10	11	10	11	48	86	85	182
90		1	3	4	4	10	11	10	11	10	10	11	10	11	10	10	11	85	85	86	182
100		1	3	4	8	10	11	10	10	11	10	11	10	10	11	10	45	85	85	86	182
110		1	4	3	10	11	10	11	10	10	11	10	11	10	10	11	77	85	85	85	183
120		1	4	5	10	11	10	10	11	10	11	10	11	10	10	33	85	85	86	85	182
130		1	4	6	11	10	10	11	10	11	10	10	11	10	11	61	86	85	85	85	183
140		1	4	7	11	10	10	11	10	11	10	10	11	10	15	86	85	85	85	85	183
150		1	4	8	10	11	10	10	11	10	11	10	10	11	42	85	85	86	85	85	182
160		1	4	8	11	10	10	11	10	11	10	10	11	10	69	85	85	85	86	85	182
170		1	4	9	10	10	11	10	11	10	10	11	10	20	85	85	85	85	86	85	182
180		1	4	9	10	11	10	10	11	10	11	10	10	45	85	86	85	85	85	85	183
XVal-He-9_040 290 fsw																					
10																	2	3	4	3	7
20											2	4	3	3	4	3	3	3	11	10	49
30							1	3	3	3	4	3	3	3	9	10	10	11	10	11	114
40						3	3	4	3	3	3	9	10	11	10	11	10	10	11	10	175
50					3	3	3	4	4	10	10	11	10	11	10	10	11	10	11	59	182
60				1	3	4	3	10	10	10	11	10	11	10	10	11	10	11	35	85	182
70				2	4	4	10	11	10	11	10	11	10	10	11	10	11	10	81	85	182
80			1	4	3	9	11	10	11	10	10	11	10	11	10	10	11	47	86	85	182
90			3	3	6	11	10	10	11	10	11	10	10	11	10	11	10	85	85	85	183
100		1	3	3	9	10	11	10	11	10	10	11	10	11	10	10	45	86	85	85	182
110		2	3	3	11	10	10	11	10	11	10	10	11	10	11	10	77	85	86	85	182
120		2	4	4	10	11	10	11	10	11	10	10	11	10	11	33	85	85	85	85	183
130		3	3	5	11	10	11	10	10	11	10	11	10	10	11	62	85	86	85	85	182
140		3	3	6	11	10	11	10	10	11	10	11	10	10	16	85	86	85	85	85	183
150		3	4	6	10	11	10	11	10	10	11	10	11	10	43	85	85	85	86	85	182
160		3	4	6	11	10	11	10	10	11	10	11	10	11	69	85	85	85	86	85	182
170		4	3	7	10	11	10	10	11	10	11	10	10	21	85	85	86	85	85	85	183
180		4	3	7	10	11	10	11	10	10	11	10	11	45	86	85	85	85	85	85	183

Table 15. XVal-He8_050 and XVal-He-9_050 Thalmann Algorithm 1.3 atm PO He-O_2 schedules (290 fsw)

BT	DECOMPRESSION STOPS (fsw) Stop times do not include travel time																				
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
XVal-He-8_050 290 fsw																					
10															1	3	4	3	4	4	7
20									1	3	4	4	3	4	3	4	4	3	8	10	42
30						2	4	3	4	3	4	4	3	4	5	11	10	11	11	11	104
40				1	4	4	3	4	3	4	4	4	10	11	11	10	11	11	11	10	162
50			1	4	3	4	4	3	4	6	11	11	10	11	11	11	10	11	11	40	185
60			3	3	4	4	3	5	11	11	10	11	11	11	10	11	11	10	11	88	186
70			4	3	4	3	8	10	11	11	11	10	11	11	11	10	11	11	51	90	186
80		1	3	4	3	8	10	11	11	11	10	11	11	10	11	11	11	11	90	90	185
90		1	3	4	5	11	11	10	11	11	10	11	11	11	10	11	11	47	90	89	186
100		1	4	3	9	11	10	11	11	10	11	11	11	10	11	11	11	80	90	89	186
110		1	4	4	10	11	11	11	10	11	11	11	10	11	11	11	32	90	89	90	186
120		1	4	6	10	11	11	11	10	11	11	10	11	11	11	10	62	90	90	89	186
130		1	4	7	11	10	11	11	11	10	11	11	11	10	11	12	89	90	89	90	186
140		1	4	8	11	10	11	11	11	10	11	11	10	11	11	39	89	90	89	90	186
150		1	4	8	11	11	11	10	11	11	11	10	11	11	11	65	89	90	89	90	185
160		1	4	9	11	10	11	11	11	10	11	11	11	10	12	89	90	89	90	90	185
170		1	4	9	11	11	10	11	11	11	10	11	11	11	36	90	89	90	89	90	186
180		1	4	10	10	11	11	10	11	11	11	10	11	11	61	89	90	89	90	89	186
XVal-He-9_050 290 fsw																					
10																	2	3	4	3	7
20											2	4	3	3	4	3	3	3	11	10	49
30							1	3	3	3	4	3	3	3	9	10	10	11	10	11	114
40						3	3	4	3	3	3	9	10	11	10	11	10	10	11	10	175
50					3	3	3	4	4	10	10	11	10	11	10	10	11	10	11	59	182
60				1	3	4	3	10	10	10	11	10	11	10	10	11	10	11	35	85	182
70				2	4	4	10	11	10	11	10	11	10	10	11	10	11	10	81	85	182
80			1	4	3	9	11	10	11	10	10	11	10	11	10	10	11	47	86	85	182
90			3	3	6	11	10	10	11	10	11	10	10	11	10	11	10	85	85	85	183
100		1	3	3	9	10	11	10	11	10	10	11	10	11	10	10	45	86	85	85	182
110		2	3	3	11	10	10	11	10	11	10	10	11	10	11	10	77	85	86	85	182
120		2	4	4	10	11	10	11	10	11	10	10	11	10	11	33	85	85	85	85	183
130		3	3	5	11	10	11	10	10	11	10	11	10	10	11	62	85	86	85	85	182
140		3	3	6	11	10	11	10	10	11	10	11	10	10	16	85	86	85	85	85	183
150		3	4	6	10	11	10	11	10	10	11	10	11	10	43	85	85	85	86	85	182
160		3	4	6	11	10	11	10	10	11	10	11	10	11	69	85	85	85	86	85	182
170		4	3	7	10	11	10	10	11	10	11	10	10	21	85	85	86	85	85	85	183
180		4	3	7	10	11	10	11	10	10	11	10	11	45	86	85	85	85	85	85	183

Table 16. XVal-He-9_040 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[20]	[120]	[200]
SDR	[1]	[2]	[0.67]	[1]	[1]
β_0 (atm)	-	-	-	-	[0.798]
M_0 (fsw)	[85]	[64]	[83]	[41.731]	[38.274]
β_1	[1]	[1]	[1]	[2]	[1.188]

Table 17. XVal-He-9_050 MPTT generating parameters. Fixed values in square brackets.

Half-Time	[10]	[20]	[20]	[120]	[190]
SDR	[1]	[2]	[0.67]	[1]	[1]
β_0 (atm)	-	-	-	-	[0.827]
M_0 (fsw)	[85]	[64]	[83]	[41.731]	[40.437]
β_1	[1]	[1]	[1]	[2]	[1.310]

Table 18. Shallow no-stop limits for 1.3 atm PO_2 diving

	Xval-He-9_023	XVal-He-9_040	Xval-He-9_050	Dive Man. $He-O_2$	Dive Man. N_2-O_2
fsw	min	min	min	min	min
30*	359	unlimited	unlimited	332	unlimited
35*	216	376	421	190	unlimited
40	unlimited	unlimited	unlimited	unlimited	unlimited
50	352	unlimited	unlimited	325	unlimited
60	155	220	220	134	297
70	101	123	123	86	130
80	75	86	86	63	70

Example XVal-He-8_040 and XVal-He-9_040 decompression schedules are given in Table 14 and Table 15. XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm decompression tables in fsw and msw for depths of 80 to 300 fsw and for an extended bottom time range are given in Appendix D through Appendix G.

Figure 6 and Figure 8 illustrate the LEM-he8n25-estimated P_{DCS} of XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm schedules. Because of the decision not to extend no-stop limits, schedules at and near the no-stop limits have P_{DCS} well below the target of 4 % or 5 %. The P_{DCS} are tabulated for fsw and msw schedules in Appendix D through Appendix G. Figure 7 and Figure 9 compare the TST for XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm schedules and optimum (shortest) TST of the corresponding LEM-he8n25 schedules. Most schedules fall near the identity line, indicating that XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm schedules have similar TST to the corresponding LEM-he8n25 schedules.

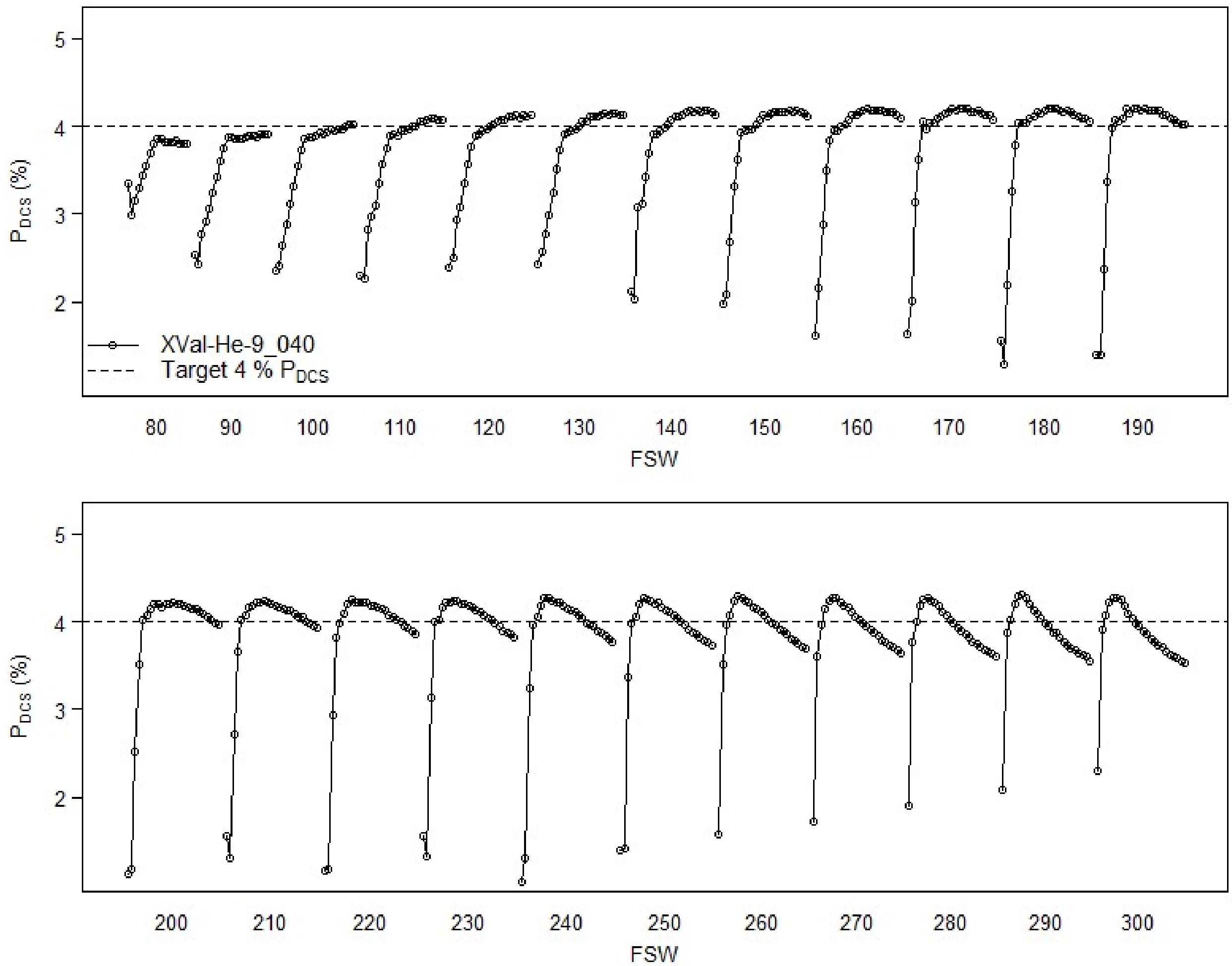

Figure 6. P_{DCS} of XVal-He-9_040 Thalmann Algorithm 1.3 atm PO_2 He-O_2 decompression schedules. Each point indicates a depth and bottom time combination. Depth groups are indicated on the x-axis. Within each depth group bottom times decrease from right to left in 10-minute increments from 240 minutes, and the left-most point is 10 minutes (260–300 fsw) or the no-stop limit.

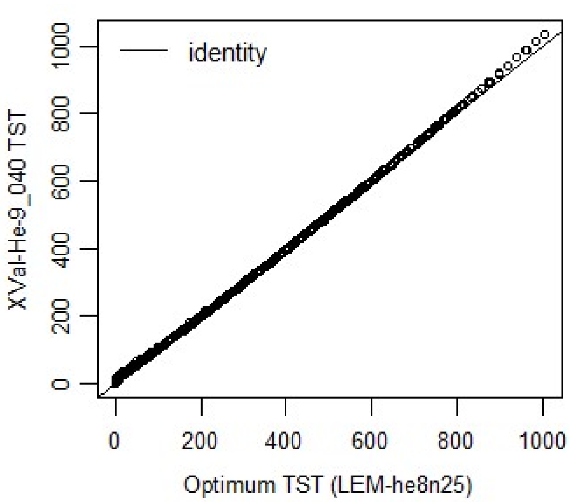

Figure 7. Comparison of TST for XVal-He-9_040 Thalmann Algorithm and LEM-he8n25 1.3 atm PO_2 He-O_2 schedules. Each point indicates a depth-bottom time combination from those illustrated in Figure 6.

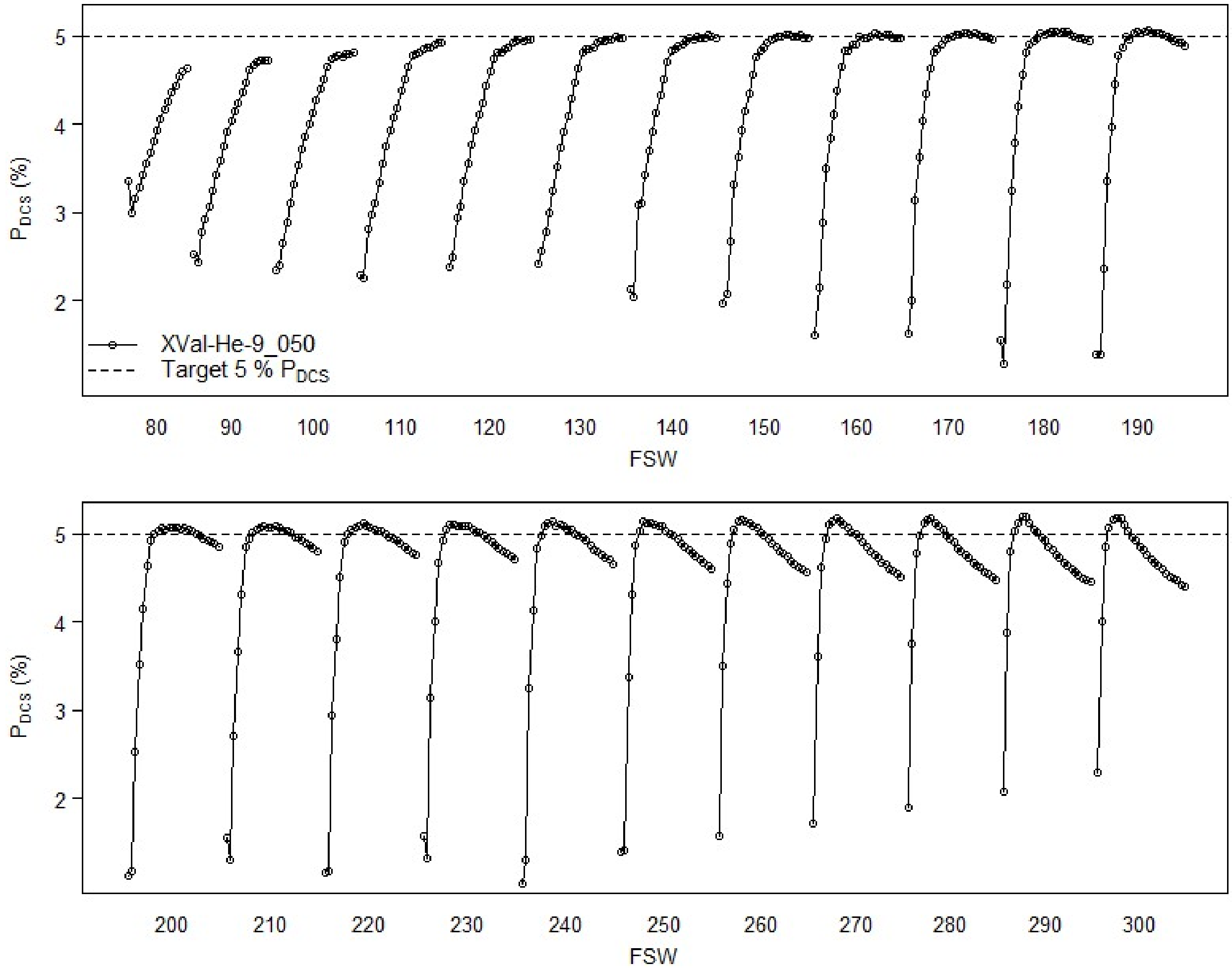

Figure 8. P_{DCS} of XVal-He-9_050Thalmann Algorithm 1.3 atm PO_2 He-O_2 decompression schedules. Each point indicates a depth and bottom time combination. Depth groups are indicated on the x-axis. Within each depth group bottom times decrease from right to left in 10-minute increments from 240 minutes, and the left-most point is 10 minutes (260–300 fsw) or the no-stop limit.

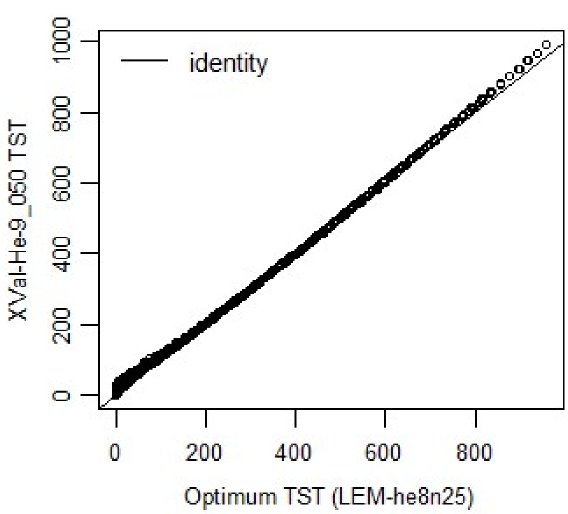

Figure 9. Comparison of TST for XVal-He-9_040 Thalmann Algorithm and LEM-he8n25 1.3 atm PO_2 He-O_2 schedules. Each point indicates a depth-bottom time combination from those illustrated in Figure 8.

DISCUSSION

The Thalmann Algorithm parameterized with XVal-He-9_023 emulates LEM-he8n25 by computing 1.3 atm PO_2 He-O_2 decompression schedules with estimated P_{DCS} near 2.3 % and which have TST similar to corresponding LEM-he8n25 schedules. This emulation is good for all depths in, and for bottom times exceeding those in, the 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual, Revision 7*. Unlike LEM-he8n25, XVal-He-9_023 Thalmann Algorithm is computationally inexpensive and can be implemented in current dive computer hardware.

The XVal-He-9_023 Thalmann Algorithm computes 1.3 atm PO_2 He-O_2 no-stop limits at depths of 90 fsw and deeper that are similar to those in the *U.S. Navy Diving Manual*. At depths of 80 fsw and shallower, XVal-He-9_023 Thalmann Algorithm produces 1.3 atm PO_2 He-O_2 no-stop limits that are longer than those in the *U.S. Navy Diving Manual*. We argue that these extended shallow no-stop limits are acceptable for the following reasons. The XVal-He-9_023 Thalmann Algorithm 1.3 atm PO_2 He-O_2 no-stop limits at 70 fsw and 80 fsw are substantially shorter than 80 fsw no-stop limits tested without DCS at NEDU (see Table 8).[4] There are no reported tests of 1.3 atm PO_2 He-O_2 no-stop limits at depths of 60 fsw and shallower, but the XVal-He-9_023 Thalmann Algorithm 1.3 atm PO_2 He-O_2 no-stop limits at these depths are substantially shorter than corresponding 1.3 atm PO_2 N_2-O_2 no-stop limits in the *U.S. Navy Diving Manual*, most of which are unlimited. There is no reason why He-O_2 no-stop limits should be shorter than N_2-O_2 no-stop limits. Indeed experimental evidence for shallow, fixed-fraction diving indicates He-O_2 no-stop limits should be the same or possibly longer than N_2-O_2 no-stop limits.[19,20]

The XVal-He-9_040 and XVal-He-9_050 parameter sets were designed to cause the Thalmann Algorithm to compute 1.3 atm PO_2 He-O_2 decompression schedules with approximately 4 % or 5 % estimated P_{DCS}, respectively. Higher accepted P_{DCS} allows accelerated decompression. The Thalmann Algorithm emulation of LEM-he8n25 schedules is slightly poorer with increasing LEM-he8n25 target P_{DCS}, such that XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm schedules have less uniform P_{DCS} than XVal-He-9_023 Thalmann Algorithm schedules. Nevertheless, the emulation is still acceptable and the XVal-He-9_040 and XVal-He-9_050 Thalmann Algorithm schedules are computed with near-optimal TST. A limited set of decompression schedules computed with XVal-He-9_040 / XVal-He-8_040 Thalmann Algorithm are currently being man-tested.

The 1.3 atm PO_2 He-O_2 Decompression Tables in the *U.S. Navy Diving Manual* were developed to support repetitive and multi-day diving. In that context, a relatively low P_{DCS} for each exposure is appropriate, accomplished using the current 1.3 atm PO_2 He-O_2 Decompression Tables or XVal-He-9_023 Thalmann Algorithm. To illustrate, before a diver sets out to perform a repetitive series of three dives, each with 2.3 % P_{DCS} , the risk of DCS on at least one of the dives is the binomial probability of no DCS on all dives and is $1-\left(\binom{3}{0}\cdot 0.023^{0}\cdot(1-0.023)^{3}\right)=0.067$. This is a higher risk than performing a single dive using an XVal-He-9_040 or XVal-He-9_050 Thalmann Algorithm accelerated decompression schedules. Such accelerated decompression might be considered for long duration, single dives.

Conversely, it would not be appropriate to perform repetitive diving using accelerated, higher P_{DCS}, decompression schedules. Although the XVal-He-9_040 or XVal-He-9_050 parameter sets were designed to allow calculation of repetitive group designators, none are provided in the decompression tables in in Appendix D through Appendix G. The XVal-He-9_023 Thalmann Algorithm tables in Appendix B and Appendix C do have repetitive group designators for all depths, including deeper than 200 fsw. During the development of the 1.3 atm PO_2 He-O_2 tables, in accord with stated requirements, repetitive diving was only tested for dives 200 fsw and shallower.[4] Schedules deeper than 200 fsw with repetitive group designators represent repetitive diving that may be feasible, but this should be confirmed with man-testing.

Several refinements of the technique used to produce the XVal-He-4 parameter set[4] were employed to develop these new parameter sets. Instead of using a set of nine compartment half-times fixed at the values chosen a priori for earlier Thalmann Algorithm applications, for the present parameter sets, half-times and SDR were selected specifically to emulate LEM-he8n25 behavior. In addition, decompression stop times in the standard set used to produce XVal-He-4 were computed only to 5-minute resolution, but were computed to 1-minute resolution in the present work. The finer stop time resolution allowed short stop times governed by half-times faster than 20 minutes (see Table 5 in results) to manifest in the standard set, and against which Thalmann Algorithm parameters could be optimized. This increased resolution was practicable because of greater available computing resources. Finally, rather than the approximation used in earlier work, a more exact objective function was minimized to optimize the Thalmann Algorithm against the standard sets.

Despite these refinements, limitations persist in the current approach. Fitting the Thalmann Algorithm with half-times and SDR used in the XVal-He-9 series (Table 10, Table 16, and Table 17) to the respective standard sets produced poorer results than using the fixed parameters. This fact indicates that additional refinement to the optimization technique is necessary. One potential refinement identified is that there is an inappropriate contribution to the SSE at the end of the bottom time. ‘Stops’ evaluated in equation (7) were any isobaric hold followed by an ascent; therefore, equation (7) was evaluated on leaving bottom. It is not advantageous to minimize this error on leaving bottom under any circumstance, but in particular for no-stop dives $\left(p_{i,\lambda} - M_{i,D_{\lambda-1}}\right)$ can be large, and is the only contribution to the SSE. In the present work, the inappropriate contribution of the no-stop dives to the SSE was reduced by use of equation (7) to minimize per profile error compared to, for instance, using equation (6) to minimize per stop error. Equation (7) results in a smaller relative contribution to the SSE of dives with fewer isobaric holds (including no-stop dives with a single hold) than of dives with more isobaric holds. However, for the same reason equation (7) likely sacrifices fit to dives with fewer decompression stops in favor of fit to the longer, deeper dives with many decompression stops, but this was not formally assessed. Another modification was tried whereby contribution to the error was excluded if there was no gas supersaturation in any compartment — a condition that prevails at end of bottom time. However, this condition also prevails during some of the shallower decompression stops, and it was found that this modification degraded the overall quality of fit and was therefore not used in any of the results described in this document. Modifications to exclude the evaluation of the error at the end of bottom time only would require redevelopment of the software that was beyond the scope of the current project.

CONCLUSIONS AND RECOMMENDATIONS

- The Thalmann Algorithm parameterized with XVal-He-9_023, XVal-He-9_040, or XVal-He-9_050 can support 1.3 atm PO_2 He-O_2 diving to 300 fsw.
- XVal-He-9_023, XVal-He-9_040, and XVal-He-9_050 parameter sets could be implemented in currently available dive computers and dive planning software that use the Thalmann Algorithm.
- Implementation of two or more of the parameter sets in a dive computer would allow selection of P_{DCS} in accord mission requirements.
- Decompression schedules computed using XVal-He-9_040 and XVal-He-9_050 parameter sets should be man-tested prior to adoption for routine use.

REFERENCES

1. K. A. Gault, *Unmanned Testing of the Modified "NSW He III 200-1.3" Navy Dive Computer,* NEDU TR 11-14, Navy Experimental Diving Unit, Jan 2012. Distribution Statement F: Futher dissemination only as directed by the Commanding Officer of the Navy Experimental Diving Unit or higher DoD authority.

2. W. A. Gerth, D. J. Doolette, K. A. Gault, and F. G. Murphy, *U.S. Navy Thalmann Algorithm Dive Planner Version 4.03 Release Archive,* NEDU SR 3, Navy Experimental Diving Unit, Sep 2013. Distribution statement F: Distribution authorized (Sep 2013) only with approval of Commanding Officer Navy Experimental Diving Unit or higher DoD authority.

3. Naval Sea Systems Command, *U.S. Navy Diving Manual*, *Revision 7, Change A, SS521-AG-PRO-010.* (Naval Sea Systems Command, Washington (DC), 2018).

4. W. A. Gerth and T. M. Johnson, *Development and Validation of 1.3 ATA PO_2-in He Decompression Tables for the MK 16 MOD 1 UBA,* NEDU TR 02-10, Navy Experimental Diving Unit, Aug 2002.

5. E. D. Thalmann, *Computer Algorithms Used in Computing the MK 15/16 Constant 0.7 ATA Oxygen Partial Pressure Decompression Tables,* NEDU TR 1-83, Navy Experimental Diving Unit, Jan 1983.

6. W. A. Gerth, *Thalmann Algorithm Decompression Table Generation Software Design Document,* NEDU TR 10-09, Navy Experimental Diving Unit, Sep 2010.

7. D. J. Doolette and W. A. Gerth, *XVal-He-4B: a Maximum Permissible Tissue Tension Table for Real-Time Thalmann Algorithm Support of Constant 1.3 Atm PO_2-in-Helium Diving to 200 Fsw,* NEDU TR 10-04, Navy Experimental Diving Unit, Apr 2010.

8. P. K. Weathersby, L. D. Homer, and E. T. Flynn, "On the Likelihood of Decompression Sickness," *Journal of Applied Physiology*, Vol. 57 (1984), pp. 815-825.

9. P. K. Weathersby, S. S. Survanshi, L. D. Homer, E. C. Parker, and E. D. Thalmann, "Predicting the Time of Occurrence of Decompression Sickness," *Journal of Applied Physiology*, Vol. 72 (1992), pp. 1541-1548.

10. P. K. Weathersby, J. R. Hays, S. S. Survanshi, L. D. Homer, B. L. Hart, E. T. Flynn, and M. E. Bradley, *Statistically Based Decompression Tables II. Equal Risk Air Diving Decompression,* Technical Report 85-17, Naval Medical Research Institute, Mar 1985.

11. R. D. Workman, *Calculation of Decompression Schedules for Nitrogen-Oxygen and Helium-Oxygen Dives,* NEDU TR 6-65, Navy Experimental Diving Unit, May 1965.

12. W. A. Gerth and D. J. Doolette, *VVal-79 Maximum Permissible Tissue Tension Table for Thalmann Algorithm Support of Air Diving,* NEDU TR 12-01, Navy Experimental Diving Unit, May 2012.

13. W. A. Gerth, *Oxygen-Accelerated Decompression of Submarine Rescue and Diving Recompression Systems (SRDRS) Operators and Tenders,* NEDU TR 05-04, Navy Experimental Diving Unit, Apr 2005.

14. D. W. Marquardt, "An Algorithm for Least-Squares Estimation of Nonlinear Parameters," *Journal of the Society for Industrial and Applied Mathematics*, Vol. 11 (1963), pp. 431-441.

15. S. S. Survanshi, E. C. Parker, D. D. Gummin, E. T. Flynn, C. B. Toner, D. J. Temple, R. Ball, and L. D. Homer, *Human Decompression Trial With 1.3 ATA Oxygen in Helium,* Technical Report 98-09, Naval Medical Research Institute, Jun 1998.

16. Navy Experimental Diving Unit letter, *Correction of Rules for Inclusion of Repetitive Group Designators in Decompression Tables for Revision 6 of the U.S. Navy Diving Manual,* 3000 Ser 00/003 of 8 Jan 2008.

17. Navy Experimental Diving Unit letter, *Decompression Tables and Oxygen Toxicity Guidance for Revision 6 of the U.S. Navy Diving Manual,* 3000 Ser 00/267 of 12 Dec 07.

18. D. J. Doolette, W. A. Gerth, and K. A. Gault, *Risk of Central Nervous System Decompression Sickness in Air Diving to No-Stop Limits,* NEDU TR 09-03, Navy Experimental Diving Unit, Jan 2009.

19. R. W. Hamilton, E. D. Thalmann, E. T. Flynn, and D. J. Temple, *No-Stop 60 Fsw Wet and Dry Dives Using Air, Heliox, and Oxygen-Nitrogen Mixtures. Data Report on Projects 88-06 and 88-06A,* Technical Report NMRC 002-002, Naval Medical Research Center, Jul 2002.

20. G. J. Duffner and H. H. Snider, *Effects of Exposing Men to Compressed Air and Helium-Oxygen Mixtures for 12 Hours at Pressures of 2–2.6 Atmospheres,* NEDU TR 1-59, Navy Experimental Diving Unit, Sep 1958.

21. W. R. Braithwaite, *Systematic Guide to Decompression Schedule Calculations,* NEDU TR 11-72, Navy Experimantal Diving Unit, Jul 1972.

22. W. A. Gerth and D. J. Doolette, *VVal-79 Thalmann Algorithm Metric and Imperial Air Decompression Tables,* NEDU TR 16-05, Navy Experimental Diving Unit, Nov 2016.

APPENDIX A MPTT TABLES

MPTT (or M-values), as defined by Workman, are the maximum permissible gas tensions at the surface (M_0) and at decompression stop depths.[11] However, for computing decompression tables, compartment gas tensions are evaluated against MPTT at the end of the preceding decompression stop, to determine if ascent to the new stop depth is permissible.[5,11,21] Therefore, in U.S. Navy MPTT tables, the MPTT (M) are associated with the stop depth at which they are evaluated, if D_λ is an integer multiple of the stop depth increment ($D_\lambda = \lambda \cdot DINC; \lambda = 0, 1, 2, 3, \ldots$), the $M_{i,D_{\lambda-1}}$ are labelled with depth D_λ. [5,11,21] So for instance in the Thalmann Algorithm, columns define compartment half-times and rows define decompression stop depths, and the surfacing MPTT (M_0) appears in the first row which is the last (shallowest) possible stop depth. If the units are fsw and the stop depth increment is 10 fsw, this first row is the 10 fsw stop. In the Thalmann Algorithm, the MPTT define the maximum permissible inert gas pressure.

The last possible stop defined by the first row of the MPTT table may not be the last allowed stop, for instance in 1.3 atm PO_2 He-O_2 decompression schedules, the last allowed stop is 20 fsw, and in the Thalmann Algorithm this is handled internally by overwriting the 20 fsw row of the MPTT table with the surfacing values from the 10 fsw row.

Unlike the Thalmann Algorithm which uses the U.S. Navy rounded conversion factor of 33 fsw/atm, the optimization software used to produce the MPTT generating functions uses the conversion factor 33.078 fsw/atm, and this factor was used to calculate M_0 values in fsw from the β_0's.

The surfacing MPTT is independent of the stop depth increment and units (e.g. fsw vs msw). Therefore, MPTT tables calculated for different stop depth increments and units are calculated from the M_0 values (not β_0's) and β_1's. For computing decompression tables with depths in meters of sea water (msw), the Thalmann Algorithm uses stop depth increments in msw but MPTT in fsw. The MPTT are projected to depth from the M_0 values using the β_1's and the Thalmann Algorithm 'metric geometic' conversion 0.3048 msw/fsw.[22]

XVAL-HE-8_023 (FSW)

	Half-times (mins)		
	10	20	210
Stop Depth		SDR	
(fsw)	1	0.67	1
10	66.016	82.825	34.165
20	76.016	92.825	44.165
30	86.016	102.825	54.165
40	96.016	112.825	64.165
50	106.016	122.825	74.165
60	116.016	132.825	84.165
70	126.016	142.825	94.165
80	136.016	152.825	104.165
90	146.016	162.825	114.165
100	156.016	172.825	124.165
110	166.016	182.825	134.165
120	176.016	192.825	144.165
130	186.016	202.825	154.165
140	196.016	212.825	164.165
150	206.016	222.825	174.165
160	216.016	232.825	184.165
170	226.016	242.825	194.165
180	236.016	252.825	204.165
190	246.016	262.825	214.165
200	256.016	272.825	224.165
210	266.016	282.825	234.165
220	276.016	292.825	244.165
230	286.016	302.825	254.165
240	296.016	312.825	264.165
250	306.016	322.825	274.165
260	316.016	332.825	284.165
270	326.016	342.825	294.165
280	336.016	352.825	304.165
290	346.016	362.825	314.165
300	356.016	372.825	324.165
310	366.016	382.825	334.165
320	376.016	392.825	344.165

XVAL-HE-8_023 (MSW)

	Half-times (mins)		
	10	20	210
Stop Depth		SDR	
(msw)	1	0.67	1
3	66.016	82.825	34.165
6	75.859	92.668	44.007
9	85.701	102.510	53.850
12	95.544	112.353	63.692
15	105.386	122.195	73.535
18	115.229	132.038	83.377
21	125.071	141.880	93.220
24	134.914	151.723	103.062
27	144.756	161.565	112.905
30	154.599	171.408	122.747
33	164.441	181.251	132.590
36	174.284	191.093	142.432
39	184.126	200.936	152.275
42	193.969	210.778	162.117
45	203.811	220.621	171.960
48	213.654	230.463	181.802
51	223.496	240.306	191.645
54	233.339	250.148	201.488
57	243.181	259.991	211.330
60	253.024	269.833	221.173
63	262.866	279.676	231.015
66	272.709	289.518	240.858
69	282.551	299.361	250.700
72	292.394	309.203	260.543
75	302.236	319.046	270.385
78	312.079	328.888	280.228
81	321.921	338.731	290.070
84	331.764	348.573	299.913
87	341.607	358.416	309.755
90	351.449	368.258	319.598
93	361.292	378.101	329.440
96	371.134	387.943	339.283

XVAL-HE-9_023 (FSW)

	Half-times (mins)				
	10	20	20	120	210
Stop Depth			SDR		
(fsw)	1	2	0.67	1	1
10	85.000	64.000	83.000	41.731	34.165
20	95.000	74.000	93.000	61.731	44.165
30	105.000	84.000	103.000	81.731	54.165
40	115.000	94.000	113.000	101.731	64.165
50	125.000	104.000	123.000	121.731	74.165
60	135.000	114.000	133.000	141.731	84.165
70	145.000	124.000	143.000	161.731	94.165
80	155.000	134.000	153.000	181.731	104.165
90	165.000	144.000	163.000	201.731	114.165
100	175.000	154.000	173.000	221.731	124.165
110	185.000	164.000	183.000	241.731	134.165
120	195.000	174.000	193.000	261.731	144.165
130	205.000	184.000	203.000	281.731	154.165
140	215.000	194.000	213.000	301.731	164.165
150	225.000	204.000	223.000	321.731	174.165
160	235.000	214.000	233.000	341.731	184.165
170	245.000	224.000	243.000	361.731	194.165
180	255.000	234.000	253.000	381.731	204.165
190	265.000	244.000	263.000	401.731	214.165
200	275.000	254.000	273.000	421.731	224.165
210	285.000	264.000	283.000	441.731	234.165
220	295.000	274.000	293.000	461.731	244.165
230	305.000	284.000	303.000	481.731	254.165
240	315.000	294.000	313.000	501.731	264.165
250	325.000	304.000	323.000	521.731	274.165
260	335.000	314.000	333.000	541.731	284.165
270	345.000	324.000	343.000	561.731	294.165
280	355.000	334.000	353.000	581.731	304.165
290	365.000	344.000	363.000	601.731	314.165
300	375.000	354.000	373.000	621.731	324.165
310	385.000	364.000	383.000	641.731	334.165
320	395.000	374.000	393.000	661.731	344.165

XVAL-HE-9_023 (MSW)

Stop Depth (msw)	Half-times (mins) 10	20	20	120	210
	SDR 1	2	0.67	1	1
3	85.000	64.000	83.000	41.731	34.165
6	94.843	73.843	92.843	61.416	44.007
9	104.685	83.685	102.685	81.101	53.850
12	114.528	93.528	112.528	100.786	63.692
15	124.370	103.370	122.370	120.471	73.535
18	134.213	113.213	132.213	140.156	83.377
21	144.055	123.055	142.055	159.841	93.220
24	153.898	132.898	151.898	179.526	103.062
27	163.740	142.740	161.740	199.211	112.905
30	173.583	152.583	171.583	218.896	122.747
33	183.425	162.425	181.425	238.581	132.590
36	193.268	172.268	191.268	258.266	142.432
39	203.110	182.110	201.110	277.951	152.275
42	212.953	191.953	210.953	297.637	162.117
45	222.795	201.795	220.795	317.322	171.960
48	232.638	211.638	230.638	337.007	181.802
51	242.480	221.480	240.480	356.692	191.645
54	252.323	231.323	250.323	376.377	201.488
57	262.165	241.165	260.165	396.062	211.330
60	272.008	251.008	270.008	415.747	221.173
63	281.850	260.850	279.850	435.432	231.015
66	291.693	270.693	289.693	455.117	240.858
69	301.535	280.535	299.535	474.802	250.700
72	311.378	290.378	309.378	494.487	260.543
75	321.220	300.220	319.220	514.172	270.385
78	331.063	310.063	329.063	533.857	280.228
81	340.906	319.906	338.906	553.542	290.070
84	350.748	329.748	348.748	573.227	299.913
87	360.591	339.591	358.591	592.912	309.755
90	370.433	349.433	368.433	612.597	319.598
93	380.276	359.276	378.276	632.282	329.440
96	390.118	369.118	388.118	651.967	339.283

XVAL-HE-8_040 (FSW)

	Half-times (mins)		
	10	20	200
Stop Depth		SDR	
(fsw)	1	0.67	1
10	70.820	83.204	38.274
20	80.820	93.204	50.157
30	90.820	103.204	62.039
40	100.820	113.204	73.921
50	110.820	123.204	85.803
60	120.820	133.204	97.685
70	130.820	143.204	109.567
80	140.820	153.204	121.449
90	150.820	163.204	133.331
100	160.820	173.204	145.213
110	170.820	183.204	157.095
120	180.820	193.204	168.977
130	190.820	203.204	180.859
140	200.820	213.204	192.741
150	210.820	223.204	204.623
160	220.820	233.204	216.506
170	230.820	243.204	228.388
180	240.820	253.204	240.270
190	250.820	263.204	252.152
200	260.820	273.204	264.034
210	270.820	283.204	275.916
220	280.820	293.204	287.798
230	290.820	303.204	299.680
240	300.820	313.204	311.562
250	310.820	323.204	323.444
260	320.820	333.204	335.326
270	330.820	343.204	347.208
280	340.820	353.204	359.090
290	350.820	363.204	370.972
300	360.820	373.204	382.855
310	370.820	383.204	394.737
320	380.820	393.204	406.619

XVAL-HE-8_040 (MSW)

	Half-times (mins)		
	10	20	200
Stop Depth		SDR	
(msw)	1	0.67	1
3	70.820	83.204	38.274
6	80.663	93.046	49.969
9	90.505	102.889	61.664
12	100.348	112.731	73.359
15	110.190	122.574	85.054
18	120.033	132.416	96.749
21	129.875	142.259	108.444
24	139.718	152.101	120.139
27	149.560	161.944	131.834
30	159.403	171.786	143.529
33	169.245	181.629	155.224
36	179.088	191.471	166.919
39	188.930	201.314	178.614
42	198.773	211.157	190.309
45	208.615	220.999	202.004
48	218.458	230.842	213.699
51	228.300	240.684	225.394
54	238.143	250.527	237.089
57	247.985	260.369	248.784
60	257.828	270.212	260.479
63	267.670	280.054	272.173
66	277.513	289.897	283.868
69	287.355	299.739	295.563
72	297.198	309.582	307.258
75	307.041	319.424	318.953
78	316.883	329.267	330.648
81	326.726	339.109	342.343
84	336.568	348.952	354.038
87	346.411	358.794	365.733
90	356.253	368.637	377.428
93	366.096	378.479	389.123
96	375.938	388.322	400.818

XVAL-HE-9_040 (FSW)

	Half-times (mins)				
	10	20	20	120	200
Stop Depth			SDR		
(fsw)	1	2	0.67	1	1
10	85.000	64.000	83.000	41.731	38.274
20	95.000	74.000	93.000	61.731	50.157
30	105.000	84.000	103.000	81.731	62.039
40	115.000	94.000	113.000	101.731	73.921
50	125.000	104.000	123.000	121.731	85.803
60	135.000	114.000	133.000	141.731	97.685
70	145.000	124.000	143.000	161.731	109.567
80	155.000	134.000	153.000	181.731	121.449
90	165.000	144.000	163.000	201.731	133.331
100	175.000	154.000	173.000	221.731	145.213
110	185.000	164.000	183.000	241.731	157.095
120	195.000	174.000	193.000	261.731	168.977
130	205.000	184.000	203.000	281.731	180.859
140	215.000	194.000	213.000	301.731	192.741
150	225.000	204.000	223.000	321.731	204.623
160	235.000	214.000	233.000	341.731	216.506
170	245.000	224.000	243.000	361.731	228.388
180	255.000	234.000	253.000	381.731	240.270
190	265.000	244.000	263.000	401.731	252.152
200	275.000	254.000	273.000	421.731	264.034
210	285.000	264.000	283.000	441.731	275.916
220	295.000	274.000	293.000	461.731	287.798
230	305.000	284.000	303.000	481.731	299.680
240	315.000	294.000	313.000	501.731	311.562
250	325.000	304.000	323.000	521.731	323.444
260	335.000	314.000	333.000	541.731	335.326
270	345.000	324.000	343.000	561.731	347.208
280	355.000	334.000	353.000	581.731	359.090
290	365.000	344.000	363.000	601.731	370.972
300	375.000	354.000	373.000	621.731	382.855
310	385.000	364.000	383.000	641.731	394.737
320	395.000	374.000	393.000	661.731	406.619

XVAL-HE-9_040 (MSW)

Stop Depth (msw)	Half-times (mins) 10	20	20	120	200
	SDR 1	2	0.67	1	1
3	85.000	64.000	83.000	41.731	38.274
6	94.843	73.843	92.843	61.416	49.969
9	104.685	83.685	102.685	81.101	61.664
12	114.528	93.528	112.528	100.786	73.359
15	124.370	103.370	122.370	120.471	85.054
18	134.213	113.213	132.213	140.156	96.749
21	144.055	123.055	142.055	159.841	108.444
24	153.898	132.898	151.898	179.526	120.139
27	163.740	142.740	161.740	199.211	131.834
30	173.583	152.583	171.583	218.896	143.529
33	183.425	162.425	181.425	238.581	155.224
36	193.268	172.268	191.268	258.266	166.919
39	203.110	182.110	201.110	277.951	178.614
42	212.953	191.953	210.953	297.637	190.309
45	222.795	201.795	220.795	317.322	202.004
48	232.638	211.638	230.638	337.007	213.699
51	242.480	221.480	240.480	356.692	225.394
54	252.323	231.323	250.323	376.377	237.089
57	262.165	241.165	260.165	396.062	248.784
60	272.008	251.008	270.008	415.747	260.479
63	281.850	260.850	279.850	435.432	272.173
66	291.693	270.693	289.693	455.117	283.868
69	301.535	280.535	299.535	474.802	295.563
72	311.378	290.378	309.378	494.487	307.258
75	321.220	300.220	319.220	514.172	318.953
78	331.063	310.063	329.063	533.857	330.648
81	340.906	319.906	338.906	553.542	342.343
84	350.748	329.748	348.748	573.227	354.038
87	360.591	339.591	358.591	592.912	365.733
90	370.433	349.433	368.433	612.597	377.428
93	380.276	359.276	378.276	632.282	389.123
96	390.118	369.118	388.118	651.967	400.818

XVAL-HE-8_050 (FSW)

	Half-times (mins)		
	10	20	190
Stop Depth		SDR	
(fsw)	1	0.67	1
10	71.500	83.171	40.437
20	81.500	93.171	53.533
30	91.500	103.171	66.628
40	101.500	113.171	79.724
50	111.500	123.171	92.820
60	121.500	133.171	105.915
70	131.500	143.171	119.011
80	141.500	153.171	132.107
90	151.500	163.171	145.203
100	161.500	173.171	158.298
110	171.500	183.171	171.394
120	181.500	193.171	184.490
130	191.500	203.171	197.585
140	201.500	213.171	210.681
150	211.500	223.171	223.777
160	221.500	233.171	236.873
170	231.500	243.171	249.968
180	241.500	253.171	263.064
190	251.500	263.171	276.160
200	261.500	273.171	289.255
210	271.500	283.171	302.351
220	281.500	293.171	315.447
230	291.500	303.171	328.543
240	301.500	313.171	341.638
250	311.500	323.171	354.734
260	321.500	333.171	367.830
270	331.500	343.171	380.925
280	341.500	353.171	394.021
290	351.500	363.171	407.117
300	361.500	373.171	420.213
310	371.500	383.171	433.308
320	381.500	393.171	446.404

XVAL-HE-8_050 (MSW)

Stop Depth (msw)	Half-times (mins) 10	20	190
	SDR 1	0.67	1
3	71.500	83.171	40.437
6	81.343	93.014	53.326
9	91.185	102.856	66.216
12	101.028	112.699	79.105
15	110.870	122.542	91.995
18	120.713	132.384	104.884
21	130.555	142.227	117.774
24	140.398	152.069	130.663
27	150.240	161.912	143.553
30	160.083	171.754	156.442
33	169.925	181.597	169.332
36	179.768	191.439	182.221
39	189.610	201.282	195.111
42	199.453	211.124	208.000
45	209.295	220.967	220.890
48	219.138	230.809	233.779
51	228.980	240.652	246.669
54	238.823	250.494	259.558
57	248.665	260.337	272.448
60	258.508	270.179	285.337
63	268.350	280.022	298.226
66	278.193	289.864	311.116
69	288.035	299.707	324.005
72	297.878	309.549	336.895
75	307.721	319.392	349.784
78	317.563	329.234	362.674
81	327.406	339.077	375.563
84	337.248	348.919	388.453
87	347.091	358.762	401.342
90	356.933	368.605	414.232
93	366.776	378.447	427.121
96	376.618	388.290	440.011

XVAL-HE-9_050 (FSW)

	Half-times (mins)				
	10	20	20	120	190
Stop Depth			SDR		
(fsw)	1	2	0.67	1	1
10	85.000	64.000	83.000	41.731	40.437
20	95.000	74.000	93.000	61.731	53.533
30	105.000	84.000	103.000	81.731	66.628
40	115.000	94.000	113.000	101.731	79.724
50	125.000	104.000	123.000	121.731	92.820
60	135.000	114.000	133.000	141.731	105.915
70	145.000	124.000	143.000	161.731	119.011
80	155.000	134.000	153.000	181.731	132.107
90	165.000	144.000	163.000	201.731	145.203
100	175.000	154.000	173.000	221.731	158.298
110	185.000	164.000	183.000	241.731	171.394
120	195.000	174.000	193.000	261.731	184.490
130	205.000	184.000	203.000	281.731	197.585
140	215.000	194.000	213.000	301.731	210.681
150	225.000	204.000	223.000	321.731	223.777
160	235.000	214.000	233.000	341.731	236.873
170	245.000	224.000	243.000	361.731	249.968
180	255.000	234.000	253.000	381.731	263.064
190	265.000	244.000	263.000	401.731	276.160
200	275.000	254.000	273.000	421.731	289.255
210	285.000	264.000	283.000	441.731	302.351
220	295.000	274.000	293.000	461.731	315.447
230	305.000	284.000	303.000	481.731	328.543
240	315.000	294.000	313.000	501.731	341.638
250	325.000	304.000	323.000	521.731	354.734
260	335.000	314.000	333.000	541.731	367.830
270	345.000	324.000	343.000	561.731	380.925
280	355.000	334.000	353.000	581.731	394.021
290	365.000	344.000	363.000	601.731	407.117
300	375.000	354.000	373.000	621.731	420.213
310	385.000	364.000	383.000	641.731	433.308
320	395.000	374.000	393.000	661.731	446.404

XVAL-HE-9_050 (MSW)

	Half-times (mins)				
	10	20	20	120	190
Stop Depth			SDR		
(msw)	1	2	0.67	1	1
3	85.000	64.000	83.000	41.731	40.437
6	94.843	73.843	92.843	61.416	53.326
9	104.685	83.685	102.685	81.101	66.216
12	114.528	93.528	112.528	100.786	79.105
15	124.370	103.370	122.370	120.471	91.995
18	134.213	113.213	132.213	140.156	104.884
21	144.055	123.055	142.055	159.841	117.774
24	153.898	132.898	151.898	179.526	130.663
27	163.740	142.740	161.740	199.211	143.553
30	173.583	152.583	171.583	218.896	156.442
33	183.425	162.425	181.425	238.581	169.332
36	193.268	172.268	191.268	258.266	182.221
39	203.110	182.110	201.110	277.951	195.111
42	212.953	191.953	210.953	297.637	208.000
45	222.795	201.795	220.795	317.322	220.890
48	232.638	211.638	230.638	337.007	233.779
51	242.480	221.480	240.480	356.692	246.669
54	252.323	231.323	250.323	376.377	259.558
57	262.165	241.165	260.165	396.062	272.448
60	272.008	251.008	270.008	415.747	285.337
63	281.850	260.850	279.850	435.432	298.226
66	291.693	270.693	289.693	455.117	311.116
69	301.535	280.535	299.535	474.802	324.005
72	311.378	290.378	309.378	494.487	336.895
75	321.220	300.220	319.220	514.172	349.784
78	331.063	310.063	329.063	533.857	362.674
81	340.906	319.906	338.906	553.542	375.563
84	350.748	329.748	348.748	573.227	388.453
87	360.591	339.591	358.591	592.912	401.342
90	370.433	349.433	368.433	612.597	414.232
93	380.276	359.276	378.276	632.282	427.121
96	390.118	369.118	388.118	651.967	440.011

OTHER THALMANN ALGORITHM PARAMETERS AND CONVENTIONS

All tables in the following appendices where computed with the following Thalmann Algorithm parameters and switches (as used for the 1.3 atm PO_2 He-O_2 Decompression Tables of the *U.S. Navy Diving Manual* since Revision 6). These parameters and switches are defined in NEDU TR 10-09.[6] Note that in the following appendices TTIS (travel time in stops) was set to T (true) whereas for the exploratory tables in the body of this report, the same parameters and switches were used with the exception that TTIS was set to F (false).

Blood Parameters

PACO2=1.50
PH2O=0.00
PVCO2=2.30
PVO2=2.00
AMBAO2=0
PBOVP=0

Other Algorithm Parameters

sPBOVP=0.000	BTMAX=720.000
TATMAX=1440.000	STIME=0.200
O2TIME=30.000	AIRTIME=5.000
O2TIME_FO2=0.700	CNDSDR_FO2=0.000
FFP=F	FORCE_STOP=F
O2CEIL=30.000	GSWLAT=0.000
GS_DEAD=T	AB_DEAD=T
OMIT_TRVL=T	TTIS=T
RNTMODE=0	RGD_SPPRSS=1
SRF_CNTRLT_MODE=1	RE_MODE=2
RNDUPD=T	LST_DOMode=1
PVSATerr=F	FRSTOPerr=F

Conventions (fsw)

60 fsw/min decent and 30 fsw/min ascent. For maximum depths of 40 fsw and deeper, descent began on 0.7 atm PO_2, switched to 1.3 atm PO_2 on descent through 32 fsw and switched back to 0.7 atm PO_2 on ascent through 12 fsw. For maximum depths of 35 fsw or shallower breathing gas was 0.7 atm PO_2 throughout.

Conventions (msw)

18 msw/min decent and 9 msw/min ascent. For maximum depths of 15 msw and deeper, descent began on 0.7 atm PO_2, switched to 1.3 atm PO_2 on descent through 9.75 msw and switched back to 0.7 atm PO_2 on ascent through 3.66 msw. For maximum depths of 12 msw or shallower breathing gas was 0.7 atm PO_2 throughout.

APPENDIX B XVAL-HE-9_023 1.3 ATM PO_2 $HE\text{-}O_2$ DECOMPRESSION TABLES (FSW)

No-Decompression Limits and Repetitive Group Designators

Depth (fsw)	No-Stop Limit	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
25	unlimited	129	269	*													
30	359	27	43	60	78	100	124	152	185	227	281	239					
35	216	19	30	41	54	67	81	97	114	133	154	178	207	216			
40	unlimited	122	246	*													
50	352	27	43	59	78	99	123	150	183	223	276	352					
60	155	15	24	32	41	51	61	72	83	95	108	123	138	155			
70	101	11	16	22	28	34	41	47	54	61	69	77	85	94	101		
80	75	8	12	17	21	26	30	35	40	45	51	56	62	67	74	75	
90	46	6	10	13	17	20	24	28	32	36	40	44	46				
100	32	5	8	11	14	17	20	23	26	30	32						
110	25	4	7	9	12	14	17	20	22	25							
120	21	4	6	8	10	13	15	17	19	21							
130	18	3	5	7	9	11	13	15	17	18							
140	15	3	4	6	8	10	12	13	15								
150	13	3	4	6	7	9	10	12	13								
160	11		3	5	6	8	9	11									
170	10		3	4	6	7	9	10									
180	9		3	4	5	6	8	9									
190	8			4	5	6	7	8									
200	7				4	5	7										

*Highest repetitive group designator during dives to these depths

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
30 fsw																						
359																			0	0	K	2.280
360																			1	1	K	2.276
420																			38	38		2.172
480																			66	66		2.078
540																			87	87		2.001
600																			103	103		1.938
660																			116	116		1.881
720																			125	125		1.842
35 fsw																						
216																			0	0	M	2.404
220																			6	6	M	2.398
230																			21	21		2.374
240																			35	35		2.348
270																			70	70		2.283
300																			99	99		2.217
330																			123	123		2.158
360																			144	144		2.098
390																			161	161		2.052
420																			176	176		2.006
450																			189	189		1.966
480																			200	200		1.932
50 fsw																						
352																			0	0	K	2.267
360																			2	2	K	2.235
420																			11	11		2.155
480																			18	18		2.086
540																			24	24		2.009
600																			28	28		1.968
660																			32	32		1.904
720																			35	35		1.856

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
60	**fsw**																					
155																			0	0	M	2.411
160																			3	3	M	2.399
170																			8	8	M	2.400
180																			13	13	M	2.391
190																			18	18		2.373
200																			23	23		2.346
210																			27	27		2.346
220																			31	31		2.338
230																			35	35		2.323
240																			39	39		2.301
250																			43	43		2.274
260																			46	46		2.275
270																			50	50		2.237
280																			53	53		2.228
290																			56	56		2.215
300																			59	59		2.197
310																			62	62		2.175
320																			64	64		2.183
330																			67	67		2.154
340																			69	69		2.154
350																			72	72		2.119
360																			74	74		2.114

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
70	**fsw**																					
101																			0	0	N	2.428
110																			9	9	N	2.399
120																			17	17		2.415
130																			25	25		2.410
140																			33	33		2.388
150																			41	41		2.350
160																			47	47		2.364
170																			54	54		2.332
180																			60	60		2.321
190																			66	66		2.298
200																			72	72		2.265
210																			77	77		2.257
220																			82	82		2.239
80	**fsw**																					
75																			0	0	O	2.839
80																			7	7		2.410
85																			13	13		2.420
90																			19	19		2.420
95																			25	25		2.412
100																			31	31		2.396
110																			42	42		2.376
120																			52	52		2.363
130																			61	61		2.361
140																			70	70		2.338
150																			78	78		2.329
160																			86	86		2.304
170																			94	94		2.263
180																			101	101		2.242
190																			107	107		2.241

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
90	**fsw**																					
46																			0	0	L	2.539
50																			1	1	M	2.436
55																			1	1	N	2.793
60																			2	2	O	2.778
65																			9	9		2.422
70																			17	17		2.424
75																			25	25		2.412
80																			33	33		2.388
85																			40	40		2.386
90																			46	46		2.408
95																			53	53		2.387
100																			59	59		2.390
110																			71	71		2.371
120																			83	83		2.322
130																			93	93		2.314
140																			103	103		2.283
150																			112	112		2.266
160																			121	121		2.239

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
100	**fsw**																					
32																			0	0	J	2.355
35																			1	1	K	2.273
40																			2	2	L	2.412
45																			3	3	M	2.53
50																			4	4	O	2.651
55																			12	12		2.398
60																			21	21		2.425
65																			31	31		2.400
70																			40	40		2.393
75																			48	48		2.409
80																			56	56		2.401
85																			64	64		2.390
90																			71	71		2.392
95																			79	79		2.353
100																			86	86		2.339
110																			99	99		2.314
120																			111	111		2.292
130																			122	122		2.287
140																			132	132		2.305

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST (min)	RG	P_{DCS}
	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20			
110	**fsw**																					
25																			0	0	I	2.305
30																			2	2	K	2.262
35																			3	3	L	2.582
40																			4	4	N	2.824
45																			7	7	O	2.491
50																			19	19		2.437
55																			30	30		2.449
60																		1	40	41		2.435
65																		1	50	51		2.434
70																		2	59	61		2.407
75																		2	68	70		2.404
80																		2	77	79		2.384
85																		2	85	87		2.385
90																		3	93	96		2.340
95																		3	100	103		2.349
100																		3	108	111		2.312
110																		3	122	125		2.291
120																		3	134	137		2.324
130																		3	146	149		2.345
140																		4	157	161		2.356

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
120	**fsw**																					
21																			0	0	I	2.392
25																			2	2	J	2.382
30																			4	4	L	2.493
35																			5	5	N	2.935
40																			9	9	O	2.504
45																		1	22	23		2.491
50																		2	34	36		2.481
55																		3	46	49		2.440
60																		3	57	60		2.452
65																	1	3	68	72		2.399
70																	1	4	77	82		2.396
75																	2	3	87	92		2.369
80																	2	4	96	102		2.337
85																	2	4	104	110		2.349
90																	3	3	113	119		2.318
95																	3	3	121	127		2.313
100																	3	3	129	135		2.305
110																	3	4	143	150		2.316
120																	3	4	157	164		2.342

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
130	**fsw**																					
18																			0	0	I	2.429
20																			1	1	I	2.569
25																			4	4	K	2.502
30																			6	6	M	2.774
35																		1	8	9	O	2.760
40																		2	22	24		2.540
45																		4	35	39		2.520
50																	1	4	49	54		2.477
55																	2	4	61	67		2.453
60																	3	4	72	79		2.441
65																	4	3	84	91		2.404
70																1	4	3	95	103		2.356
75																1	4	4	104	113		2.355
80																2	3	4	114	123		2.323
85																2	4	4	123	133		2.306
90																2	4	5	131	142		2.308
95																3	3	5	139	150		2.337
100																3	3	6	147	159		2.328
110																3	4	6	162	175		2.366
120																3	4	7	176	190		2.413

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
140	**fsw**																					
15																			0	0	H	2.127
20																			4	4	J	2.039
25																			6	6	L	2.662
30																		1	8	9	N	2.824
35																		3	19	22	N	2.576
40																	2	3	35	40		2.535
45																	3	3	49	55		2.550
50																1	3	4	63	71		2.485
55																2	3	4	76	85		2.445
60																3	3	6	87	99		2.401
65																3	4	7	97	111		2.401
70															1	3	4	8	108	124		2.340
75															1	4	3	10	117	135		2.327
80															2	3	4	10	127	146		2.302
85															2	4	3	11	136	156		2.308
90															2	4	4	11	144	165		2.340
95															2	4	5	11	152	174		2.365
100															3	3	6	10	162	184		2.363

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
150	**fsw**																					
13																			0	0	H	1.977
15																			2	2	I	1.907
20																			6	6	K	2.084
25																		2	7	9	M	2.591
30																	1	4	12	17	O	2.556
35																	2	4	30	36		2.607
40																1	3	4	47	55		2.565
45																2	4	4	62	72		2.519
50																3	4	7	74	88		2.509
55															1	4	3	10	86	104		2.453
60															2	4	4	11	98	119		2.394
65															3	4	6	10	110	133		2.358
70															4	3	8	10	120	145		2.364
75														1	3	4	9	10	131	158		2.334
80														1	4	4	9	11	140	169		2.334
85														2	3	4	10	11	149	179		2.368
90														2	4	4	10	11	159	190		2.372

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
160	**fsw**																					
11																			0	0	G	1.616
15																			4	4	I	1.753
20																		2	7	9	L	1.945
25																	1	4	7	12	N	2.622
30																	4	3	22	29	N	2.604
35																2	4	3	42	51		2.573
40																3	4	6	57	70		2.584
45															1	4	4	10	71	90		2.522
50															3	3	6	11	85	108		2.462
55														1	3	4	8	11	98	125		2.414
60														2	3	4	10	11	110	140		2.386
65														3	3	5	11	11	122	155		2.336
70														3	4	7	10	11	133	168		2.368
75													1	3	4	8	11	10	144	181		2.378
80													1	4	3	10	10	11	154	193		2.377
85													2	3	4	10	11	10	165	205		2.388
90													2	3	4	11	11	10	174	215		2.442
170	**fsw**																					
10																			0	0	G	1.636
15																			6	6	J	1.667
20																	1	3	8	12	L	1.946
25																1	3	4	11	19	O	2.548
30																3	4	3	33	43		2.573
35															2	3	4	5	52	66		2.555
40															3	4	3	11	66	87		2.564
45														1	3	4	8	11	81	108		2.533
50														2	4	4	11	11	96	128		2.444
55														3	4	7	11	11	109	145		2.430
60													1	4	3	10	11	11	122	162		2.381
65													2	4	4	11	11	10	135	177		2.404
70													3	4	6	10	11	11	147	192		2.371
75													4	3	8	10	11	11	158	205		2.405
80												1	3	4	9	11	10	11	169	218		2.433

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																			TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
180	**fsw**																					
9																			0	0	G	1.559
10																			2	2	H	1.286
15																		1	8	9	J	1.469
20																	3	4	7	14	M	2.139
25																3	4	4	20	31	N	2.543
30															3	3	4	4	43	57		2.550
35														1	4	4	3	10	60	82		2.546
40														3	3	4	8	11	77	106		2.512
45														4	3	7	10	11	92	127		2.517
50													2	3	4	10	11	11	107	148		2.456
55													3	4	6	10	11	11	122	167		2.403
60												1	3	4	9	10	11	11	136	185		2.389
65												2	3	4	11	11	10	11	149	201		2.404
70												3	3	6	10	11	11	11	161	216		2.401
190	**fsw**																					
8																			0	0	G	1.392
10																			3	3	H	1.397
15																		3	8	11	K	1.530
20																2	4	3	8	17	N	2.363
25															3	3	4	4	30	44	N	2.518
30														2	4	3	4	7	52	72		2.531
35													1	4	3	4	6	11	70	99		2.519
40													2	4	4	5	11	11	87	124		2.507
45													4	3	4	11	11	10	105	148		2.455
50												1	4	3	9	11	11	10	121	170		2.432
55												2	4	5	11	10	11	11	135	189		2.425
60												4	3	8	11	10	11	11	149	207		2.449
65											1	4	4	10	10	11	11	11	163	225		2.425
70											2	4	5	10	11	11	11	10	177	241		2.489

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST (min)	RG	P_{DCS}
	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20			
200	**fsw**																					
7																			0	0	F	1.133
10																			5	5	H	1.172
15																	2	4	7	13	L	1.672
20															1	4	3	4	12	24	O	2.498
25														2	4	3	4	3	41	57		2.493
30													2	3	4	4	3	11	61	88		2.495
35												1	3	4	3	4	11	11	80	117		2.487
40												2	4	3	4	10	11	11	99	144		2.454
45												3	4	4	9	10	11	11	117	169		2.419
50											1	3	4	7	11	11	10	11	133	191		2.451
55											2	4	3	11	11	11	10	11	149	212		2.452
60											3	4	7	10	11	11	10	11	164	231		2.507
210	**fsw**																					
7																			0	0	G	1.563
10																			6	6	I	1.305
15																1	3	4	7	15	M	1.866
20															4	3	4	3	21	35	N	2.492
25													1	4	4	3	4	5	50	71		2.477
30												1	4	4	3	4	7	11	71	105		2.461
35												4	3	4	3	8	11	11	91	135		2.460
40											2	4	3	4	8	10	11	11	111	164		2.422
45											3	4	3	7	11	11	10	11	130	190		2.412
50										1	3	4	5	11	11	10	11	11	146	213		2.455
55										1	4	4	9	11	11	11	10	11	163	235		2.505
60										3	3	6	11	11	10	11	11	13	177	256		2.480

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
220	**fsw**																					
6																			0	0	F	1.168
10																		1	7	8	I	1.258
15																3	3	4	7	17	M	2.077
20														3	3	4	3	4	30	47	N	2.470
25												1	3	4	4	3	4	8	58	85		2.477
30											1	3	4	4	3	4	11	10	81	121		2.405
35											3	4	3	4	5	11	11	10	103	154		2.426
40										2	3	4	4	5	11	10	11	11	123	184		2.409
45										3	4	3	5	11	10	11	11	11	142	211		2.422
50									1	3	4	3	11	11	10	11	11	11	160	236		2.467
55									1	4	3	9	10	11	11	11	10	12	177	259		2.525
230	**fsw**																					
6																			0	0	G	1.568
10																		3	7	10	J	1.198
15															2	3	4	3	8	20	N	2.282
20													2	3	4	3	4	4	39	59		2.459
25												3	4	3	4	4	5	10	66	99		2.480
30											4	3	4	3	4	8	10	11	91	138		2.431
35										3	3	4	4	3	9	11	11	11	114	173		2.392
40									1	4	4	3	4	10	10	11	11	11	136	205		2.379
45									3	3	4	4	9	11	11	10	11	11	156	233		2.437
50									4	3	4	8	11	11	11	10	11	11	175	259		2.507
55								1	4	3	7	11	10	11	11	11	10	29	178	286		2.482

BT (min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	RG	P_{DCS}
	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					
240	**fsw**																					
5																			0	0	F	1.038
10																	1	3	8	12	J	1.280
15															4	3	4	3	10	24	O	2.464
20												1	3	4	3	4	4	4	48	71		2.446
25											3	3	4	3	4	4	8	11	75	115		2.446
30										3	4	3	4	3	5	10	11	11	101	155		2.414
35									3	3	4	3	4	6	11	11	10	11	126	192		2.384
40								1	4	3	4	4	7	11	10	11	11	11	148	225		2.427
45								3	3	4	3	8	11	10	11	11	11	10	171	256		2.461
50								4	3	4	6	11	11	11	10	11	11	25	178	285		2.46
250	**fsw**																					
5																			0	0	G	1.399
10																	2	4	7	13	K	1.432
15														2	4	4	3	4	17	34	N	2.472
20												3	4	3	4	3	4	7	56	84		2.433
25										2	4	3	4	3	4	4	11	11	85	131		2.404
30									3	3	4	3	4	4	8	10	11	11	113	174		2.361
35								2	4	3	4	4	3	11	10	11	11	11	138	212		2.373
40							1	4	3	4	3	5	11	11	10	11	11	11	162	247		2.415
45							2	4	4	3	5	11	11	11	10	11	11	19	177	279		2.470
50							3	4	4	4	11	11	11	10	11	11	11	42	177	310		2.481
260	**fsw**																					
5																			1	1	G	1.323
10																1	3	4	7	15	L	1.575
15													1	4	3	4	3	4	25	44	N	2.461
20											2	4	3	4	3	4	4	9	64	97		2.422
25									1	4	3	4	4	3	4	7	11	11	95	147		2.386
30								2	4	3	4	3	4	5	10	11	11	11	123	191		2.371
35							2	3	4	4	3	4	7	11	11	11	10	11	151	232		2.384
40						1	3	4	3	4	4	9	11	11	10	11	11	10	177	269		2.45
45						2	4	3	4	4	10	11	10	11	11	11	10	36	178	305		2.436

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop 200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	RG	P_{DCS}
270	**fsw**																					
5																			2	2	G	1.265
10																2	4	4	7	17	L	1.729
15													3	4	3	4	3	4	33	54	M	2.457
20										1	4	3	4	4	3	4	5	10	72	110		2.432
25								1	3	4	3	4	3	4	4	10	11	11	104	162		2.382
30							2	3	4	3	4	4	3	8	11	11	11	10	136	210		2.340
35						1	4	4	3	4	3	5	11	10	11	11	11	10	164	252		2.403
40						4	3	4	3	4	7	11	10	11	11	11	10	25	178	292		2.434
45					2	4	3	4	3	8	11	11	11	10	11	11	11	51	178	329		2.460
280	**fsw**																					
5																			3	3	H	1.236
10															1	3	4	3	8	19	M	1.884
15												2	3	4	4	3	4	3	42	65	N	2.438
20										3	4	4	3	4	3	4	8	11	80	124		2.405
25								3	4	3	4	3	4	4	7	10	11	11	115	179		2.342
30						1	4	3	4	3	4	4	4	11	11	10	11	11	146	227		2.379
35					1	4	3	4	3	4	4	8	11	11	11	10	11	11	176	272		2.452
40					3	4	4	3	4	4	11	11	10	11	11	10	11	41	177	315		2.451
45				2	3	4	4	3	6	11	10	11	11	11	10	11	11	69	177	354		2.477
290	**fsw**																					
5																			4	4	H	1.216
10															2	4	3	4	7	20	M	2.091
15												4	3	4	4	3	4	3	50	75		2.442
20									2	4	4	3	4	3	4	4	10	11	88	137		2.410
25							2	4	4	3	4	3	4	4	10	10	11	11	125	195		2.341
30					1	3	4	3	4	4	3	4	8	11	11	10	11	11	158	246		2.401
35				1	3	4	3	4	4	3	6	10	11	11	11	10	11	24	178	294		2.432
40				3	4	3	4	4	3	9	11	10	11	11	11	10	11	57	177	339		2.458
45			2	3	4	3	4	4	10	11	11	11	10	11	11	10	20	78	178	381		2.459

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																		TST		
(min)	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	RG	P_{DCS}
300	**fsw**																					
5																			5	5	H	1.212
10														1	3	4	3	4	7	22	N	2.287
15											2	4	4	3	4	3	4	6	56	86		2.443
20								2	3	4	3	4	3	4	4	6	11	11	97	152		2.380
25						2	3	4	3	4	4	3	4	6	11	11	11	10	136	212		2.338
30					3	4	3	4	4	3	4	5	11	11	10	11	11	11	170	265		2.425
35				4	3	4	3	4	4	3	10	11	11	10	11	11	11	39	178	317		2.424
40			3	3	4	4	3	4	6	11	11	10	11	11	11	10	11	73	178	364		2.452
310	**fsw**																					
6																		3	7	10		1.187
10														2	4	3	4	3	9	25		2.441
15										1	4	3	4	4	3	4	3	8	64	98		2.410
20							1	3	4	3	4	4	3	4	3	10	11	10	107	167		2.348
25					1	3	4	4	3	4	3	4	4	10	10	11	11	11	145	228		2.376
30				3	3	4	4	3	4	3	4	9	11	10	11	11	11	17	178	286		2.404
35			3	4	3	4	4	3	4	7	11	10	11	11	10	11	11	55	177	339		2.451
40		3	3	4	3	4	4	3	11	11	10	11	11	11	10	11	24	77	178	389		2.45
320	**fsw**																					
6																	1	4	7	12		1.207
10														4	3	4	3	4	15	33		2.439
15										3	4	3	4	3	4	4	3	10	70	108		2.426
20							3	3	4	4	3	4	3	4	5	11	11	11	115	181		2.340
25					3	4	4	3	4	3	4	4	6	11	10	11	11	11	156	245		2.397
30			2	4	3	4	4	3	4	3	6	11	11	10	11	11	11	31	178	307		2.396
35		3	3	4	4	3	4	3	5	10	11	11	10	11	11	11	10	70	178	362		2.458
40	2	4	3	4	4	3	4	8	11	11	10	11	11	11	10	11	42	78	177	415		2.452

APPENDIX C XVAL-HE-9_023 1.3 ATM PO_2 $HE\text{-}O_2$ DECOMPRESSION TABLES (MSW)

No-Decompression Limits and Repetitive Group Designators

Depth (msw)	No-Stop Limit	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
6	unlimited	147	340	*													
9	384	28	44	62	82	104	130	160	197	244	308	384					
12	162	15	24	33	42	52	63	74	86	99	113	128	144	162			
15	394	29	46	64	84	107	134	165	203	252	322	394					
18	164	16	25	34	43	53	64	75	87	100	115	130	147	164			
21	105	11	17	23	29	35	42	49	56	64	72	80	89	98	105		
24	77	8	13	17	22	26	31	36	42	47	52	58	64	70	76	77	
27	50	7	10	14	17	21	25	29	33	37	41	46	50				
30	34	5	8	11	14	17	21	24	27	30	34						
33	26	4	7	10	12	15	18	20	23	26							
36	22	4	6	8	11	13	15	18	20	22							
39	18	3	5	7	9	11	13	15	18								
42	16	3	5	6	8	10	12	14	16								
45	13	3	4	6	7	9	11	12	13								
48	12	4	5	7	8	10	11	12									
51	10	3	5	6	7	9	10										
54	9	3	4	5	7	8	9										
57	8	4	5	6	7	8											
60	8	4	6	7	8												

*Highest repetitive group designator during dives to these depths

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
9	**msw**																					
384																			0	0	K	2.215
420																			21	21	K	2.146
480																			47	47		2.061
540																			68	68		1.977
600																			83	83		1.917
660																			96	96		1.856
720																			105	105		1.814
12	**msw**																					
162																			0	0	M	2.404
170																			17	17	M	2.387
180																			37	37		2.359
190																			55	55		2.331
200																			71	71		2.307
210																			86	86		2.280
220																			100	100		2.252
230																			113	113		2.224
240																			125	125		2.199
270																			156	156		2.130
300																			181	181		2.074
330																			203	203		2.015
360																			221	221		1.968
390																			237	237		1.921
420																			250	250		1.887
450																			262	262		1.850
480																			272	272		1.820
15	**msw**																					
394																			0	0	K	2.156
420																			4	4	K	2.104
480																			11	11		2.023
540																			16	16		1.969
600																			21	21		1.888
660																			24	24		1.850
720																			27	27		1.797

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
18	**msw**																					
164																			0	0	M	2.370
170																			3	3	M	2.365
180																			8	8	M	2.348
190																			13	13		2.324
200																			18	18		2.290
210																			22	22		2.284
220																			26	26		2.271
230																			30	30		2.250
240																			33	33		2.258
250																			37	37		2.227
260																			40	40		2.223
270																			44	44		2.181
280																			47	47		2.169
290																			50	50		2.151
300																			52	52		2.164
310																			55	55		2.138
320																			58	58		2.110
330																			60	60		2.111
340																			63	63		2.076
350																			65	65		2.071
360																			67	67		2.063

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST (min)	RG	P_{DCS}
	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6			
21	**msw**																					
105																			0	0	N	2.385
110																			5	5	N	2.361
120																			13	13		2.366
130																			21	21		2.352
140																			29	29		2.321
150																			36	36		2.308
160																			42	42		2.315
170																			49	49		2.275
180																			55	55		2.258
190																			60	60		2.263
200																			66	66		2.225
210																			71	71		2.211
220																			76	76		2.189
24	**msw**																					
77																			0	0	O	2.673
80																			3	3		2.393
85																			10	10		2.361
90																			15	15		2.388
95																			21	21		2.373
100																			27	27		2.351
110																			37	37		2.354
120																			47	47		2.331
130																			56	56		2.319
140																			65	65		2.287
150																			73	73		2.271
160																			81	81		2.239
170																			88	88		2.225
180																			95	95		2.198
190																			101	101		2.192

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
27	**msw**																					
50																			0	0	L	2.576
55																			1	1	M	2.530
60																			1	1	N	2.853
65																			6	6	O	2.380
70																			14	14		2.372
75																			21	21		2.386
80																			29	29		2.354
85																			36	36		2.345
90																			42	42		2.361
95																			49	49		2.332
100																			55	55		2.330
110																			67	67		2.300
120																			78	78		2.275
130																			88	88		2.259
140																			97	97		2.254
150																			106	106		2.229
160																			115	115		2.192

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	RG	P_{DCS}
30	**msw**																				
34																		0	0	J	2.349
35																		1	1	K	2.016
40																		2	2	L	2.155
45																		2	2	M	2.630
50																		3	3	N	2.698
55																		8	8	O	2.393
60																		18	18		2.375
65																		27	27		2.374
70																		36	36		2.357
75																		44	44		2.360
80																		52	52		2.349
85																		60	60		2.326
90																		67	67		2.326
95																		74	74		2.315
100																		81	81		2.294
110																		93	93		2.293
120																		105	105		2.262
130																		116	116		2.244
140																		127	127		2.217

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
33	**msw**																					
26																			0	0	I	2.236
30																			1	1	K	2.452
35																			3	3	L	2.298
40																			4	4	M	2.534
45																			5	5	O	2.742
50																			16	16		2.386
55																			27	27		2.386
60																			37	37		2.397
65																		1	46	47		2.386
70																		1	56	57		2.357
75																		1	65	66		2.346
80																		2	73	75		2.315
85																		2	81	83		2.309
90																		2	89	91		2.290
95																		2	96	98		2.293
100																		3	103	106		2.256
110																		3	116	119		2.256
120																		3	129	132		2.241
130																		3	141	144		2.249
140																		3	152	155		2.279

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
36	**msw**																					
22																		0	0	I	2.387
25																		2	2	J	2.101
30																		3	3	L	2.642
35																		5	5	M	2.622
40																		6	6	O	2.961
45																	1	19	20		2.434
50																	2	31	33		2.409
55																	2	43	45		2.403
60																	3	53	56		2.393
65																	4	63	67		2.368
70																1	3	73	77		2.358
75																1	4	82	87		2.333
80																2	3	91	96		2.318
85																2	3	100	105		2.291
90																2	4	108	114		2.258
95																2	4	116	122		2.245
100																2	4	123	129		2.263
110																3	3	138	144		2.260
120																3	3	151	157		2.306

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																		TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
39	**msw**																					
18																			0	0	H	2.154
20																			1	1	I	2.276
25																			4	4	K	2.199
30																			6	6	M	2.462
35																			7	7	O	2.994
40																		2	19	21		2.477
45																		3	33	36		2.455
50																	1	4	45	50		2.421
55																	2	3	58	63		2.393
60																	3	3	69	75		2.367
65																	3	4	79	86		2.366
70																1	3	4	90	98		2.309
75																1	3	4	100	108		2.292
80																1	4	3	109	117		2.295
85																2	3	4	118	127		2.260
90																2	3	4	126	135		2.283
95																2	4	4	134	144		2.281
100																2	4	4	142	152		2.296
110																3	3	5	157	168		2.319
120																3	3	6	171	183		2.354

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST (min)	RG	P_{DCS}
	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6			
42	**msw**																					
16																			0	0	H	2.281
20																			3	3	J	2.210
25																			6	6	L	2.345
30																		1	7	8	N	2.866
35																		3	16	19	N	2.511
40																	1	4	31	36	N	2.498
45																	2	4	45	51		2.498
50																	4	3	59	66		2.444
55																1	4	3	72	80		2.408
60																2	4	4	83	93		2.377
65																3	3	6	94	106		2.326
70																3	4	7	103	117		2.329
75															1	3	4	8	113	129		2.279
80															1	4	3	9	122	139		2.280
85															1	4	4	9	131	149		2.278
90															2	3	4	10	140	159		2.261
95															2	4	3	11	148	168		2.281
100															2	4	4	11	156	177		2.294

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
45	**msw**																					
13																			0	0	H	1.738
15																			2	2	H	1.658
20																			6	6	K	1.816
25																		2	7	9	M	2.295
30																		4	9	13	O	2.541
35																	2	3	27	32		2.573
40																	3	4	43	50		2.549
45																2	3	4	58	67		2.490
50																3	4	5	71	83		2.443
55															1	3	4	8	83	99		2.387
60															2	3	4	10	94	113		2.347
65															2	4	5	10	105	126		2.325
70															3	4	6	10	116	139		2.284
75															4	3	8	10	126	151		2.265
80														1	3	4	8	11	135	162		2.269
85														1	4	3	10	10	144	172		2.301
90														2	3	4	10	10	154	183		2.288

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
48	**msw**																					
12																			0	0	H	1.918
15																			4	4	I	1.509
20																		1	7	8	K	1.995
25																	1	3	8	12	N	2.363
30																	3	4	19	26	N	2.537
35																1	4	4	37	46		2.564
40																3	3	5	54	65		2.536
45															1	4	3	9	68	85		2.457
50															2	4	5	10	81	102		2.420
55															4	3	7	11	93	118		2.382
60														1	4	3	10	10	106	134		2.318
65														2	4	4	10	11	117	148		2.287
70														3	3	6	10	11	128	161		2.277
75														3	4	7	10	11	138	173		2.299
80													1	3	4	8	10	11	149	186		2.277
85													1	4	3	9	11	10	159	197		2.304
90													1	4	4	9	11	10	169	208		2.320
51	**msw**																					
10																			0	0	G	1.423
15																			6	6	J	1.434
20																		3	7	10	L	2.098
25																	3	4	9	16	O	2.495
30																3	3	4	29	39		2.528
35															1	4	3	5	48	61		2.526
40															2	4	3	10	63	82		2.515
45															4	3	7	11	77	102		2.474
50														2	3	4	10	11	91	121		2.416
55														3	4	6	10	11	105	139		2.345
60													1	3	4	8	11	10	118	155		2.317
65													2	3	4	10	11	10	130	170		2.293
70													2	4	5	10	11	11	141	184		2.288
75													3	4	6	11	10	11	152	197		2.313
80													4	3	8	10	11	10	164	210		2.320

DECOMPRESSION STOPS (msw)
Stop times (min) include travel time, except first stop

BT (min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	RG	P_{DCS}
54	**msw**																					
9																			0	0	G	1.353
10																			1	1	G	1.498
15																		1	7	8	J	1.498
20																	2	4	7	13	M	2.085
25																3	3	4	17	27	N	2.511
30															2	4	3	4	40	53		2.491
35														1	3	4	3	9	57	77		2.494
40														2	4	3	7	11	73	100		2.461
45														3	4	5	10	11	88	121		2.437
50													1	4	3	9	11	10	103	141		2.399
55													2	4	5	11	10	11	117	160		2.335
60													4	3	8	10	11	10	131	177		2.313
65												1	4	3	10	11	10	11	143	193		2.304
70												2	4	4	11	10	11	10	156	208		2.314
57	**msw**																					
8																			0	0	G	1.199
10																			3	3	H	1.192
15																		3	7	10	K	1.512
20																2	3	4	7	16	N	2.255
25															2	4	3	4	27	40	N	2.471
30														2	3	4	3	6	49	67		2.479
35														4	3	4	5	11	66	93		2.471
40													2	3	4	5	10	11	83	118		2.442
45													3	3	4	10	11	10	99	140		2.437
50												1	3	4	7	11	10	11	115	162		2.364
55												2	4	3	11	10	11	11	129	181		2.344
60												3	4	6	11	10	11	10	144	199		2.349
65											1	4	3	9	10	11	10	11	157	216		2.346
70											2	3	4	11	10	11	10	11	170	232		2.352

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST (min)	RG	P_{DCS}
	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6			
60	**msw**																					
8																			0	0	G	1.663
10																			4	4	H	1.293
15																	2	3	7	12	L	1.630
20															1	3	4	3	10	21	O	2.441
25														2	3	4	3	4	37	53		2.442
30													1	4	3	4	3	10	57	82		2.463
35													3	4	3	4	10	10	76	110		2.451
40												2	3	4	3	10	10	11	94	137		2.407
45												3	3	4	8	10	11	11	111	161		2.377
50												3	4	6	11	10	11	10	127	182		2.398
55											1	4	4	9	11	10	11	10	143	203		2.378
60											3	3	6	10	11	10	11	11	157	222		2.369
63	**msw**																					
7																			0	0	G	1.358
10																			6	6	I	1.109
15																	4	3	7	14	L	1.768
20															3	4	3	4	18	32	N	2.430
25													1	3	4	3	4	5	45	65		2.468
30												1	3	4	3	4	6	11	66	98		2.439
35												3	4	3	4	7	10	11	87	129		2.389
40											1	4	3	4	7	10	11	11	105	156		2.389
45											3	3	4	5	11	11	10	11	124	182		2.334
50											3	4	4	11	10	11	10	11	140	204		2.382
55										1	3	4	9	10	11	10	11	10	157	226		2.405
60										2	4	4	11	11	10	11	10	11	172	246		2.407

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
66	**msw**																					
6																			0	0	F	0.994
10																			7	7	I	1.246
15																2	4	3	7	16	M	1.976
20														2	4	3	4	3	27	43	N	2.425
25													3	4	3	4	4	7	54	79		2.439
30												3	4	4	3	4	10	10	76	114		2.419
35											3	3	4	3	4	11	10	11	97	146		2.379
40										1	4	3	4	4	11	10	11	10	118	176		2.340
45										2	4	3	4	11	10	11	10	11	136	202		2.360
50										3	4	3	10	10	11	10	11	10	154	226		2.410
55									1	3	4	7	10	11	11	10	11	10	172	250		2.409
69	**msw**																					
6																			0	0	G	1.363
10																		2	7	9	J	1.213
15															1	4	3	4	7	19	N	2.177
20													1	4	3	4	3	4	35	54		2.433
25												3	3	4	3	4	4	10	62	93		2.423
30											3	4	3	4	3	7	10	11	86	131		2.380
35										2	4	3	4	3	9	10	11	10	109	165		2.341
40									1	3	4	4	3	9	10	11	11	10	130	196		2.332
45									2	4	3	4	8	11	11	10	11	10	150	224		2.359
50									3	4	3	8	10	11	10	11	11	10	168	249		2.427
55								1	3	4	5	11	10	11	10	11	11	24	174	275		2.397

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																			TST		
(min)	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	RG	P_{DCS}
72	**msw**																					
5																			0	0	F	0.877
10																		4	7	11	J	1.211
15															3	4	3	4	9	23	N	2.347
20													3	4	3	4	4	3	44	65		2.435
25											2	4	3	4	3	4	7	11	71	109		2.382
30										2	4	4	3	4	3	10	11	11	96	148		2.350
35									2	3	4	4	3	5	11	11	10	11	120	184		2.320
40								1	3	4	3	4	6	11	10	11	10	11	142	216		2.344
45								2	4	3	4	6	11	10	11	10	11	10	164	246		2.373
50								3	4	3	6	10	11	10	11	11	10	21	174	274		2.399
75	**msw**																					
5																			0	0	G	1.206
10																	2	3	8	13	K	1.332
15														2	3	4	3	4	14	30	N	2.424
20												2	4	4	3	4	3	6	52	78		2.412
25										1	4	3	4	4	3	4	10	11	80	124		2.365
30									2	4	3	4	3	4	7	10	11	10	107	165		2.338
35								2	3	4	3	4	3	10	10	11	10	11	132	203		2.304
40								4	3	4	3	4	11	10	11	10	11	10	155	236		2.371
45							2	3	4	3	5	10	11	10	11	11	10	14	174	268		2.412
50							3	3	4	4	10	11	10	11	11	10	11	37	174	299		2.392
78	**msw**																					
5																			0	0	G	1.575
10																	3	4	7	14	K	1.494
15													1	3	4	3	4	3	22	40	N	2.420
20											2	3	4	3	4	3	4	9	59	91		2.394
25									1	3	4	3	4	3	4	7	10	11	89	139		2.359
30								1	4	4	3	4	3	4	10	11	11	10	118	183		2.297
35							1	4	3	4	3	4	6	11	11	10	11	10	144	222		2.328
40							3	4	3	4	3	9	10	11	11	10	11	10	168	257		2.406
45						2	3	4	3	4	9	10	11	11	10	11	10	31	174	293		2.370

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	RG	P_{DCS}
81	**msw**																					
5																			2	2	G	1.079
10																2	3	4	7	16	L	1.635
15													2	4	4	3	4	3	30	50	N	2.408
20										1	3	4	3	4	3	4	4	11	67	104		2.372
25									3	4	3	4	3	4	3	10	11	11	98	154		2.341
30							1	4	3	4	3	4	3	8	10	11	10	11	129	201		2.288
35						1	3	4	3	4	4	3	11	10	11	10	11	11	155	241		2.361
40						3	4	3	4	3	6	11	10	11	10	11	10	20	174	280		2.386
45					1	4	4	3	4	7	10	11	10	11	10	11	11	46	174	317		2.39
84	**msw**																					
5																			3	3	G	1.048
10																3	4	3	7	17	M	1.814
15												1	4	3	4	3	4	3	38	60	M	2.391
20										3	3	4	3	4	4	3	7	11	75	117		2.362
25								2	4	4	3	4	3	4	6	10	11	11	108	170		2.326
30							4	3	4	3	4	3	4	11	11	10	11	10	140	218		2.304
35						4	3	4	3	4	3	8	11	10	11	10	11	11	168	261		2.377
40					3	3	4	3	4	3	11	10	11	11	10	11	10	35	174	303		2.380
45				1	4	3	4	3	5	11	10	11	10	11	11	10	11	62	174	341		2.406
87	**msw**																					
5																			4	4	H	1.028
10															2	3	4	3	7	19	M	1.985
15												3	4	3	4	3	4	3	46	70	M	2.386
20									2	3	4	4	3	4	3	4	9	11	83	130		2.367
25							2	3	4	3	4	3	4	4	9	10	11	10	119	186		2.291
30						3	4	3	4	3	4	3	8	11	10	11	10	11	151	236		2.325
35					3	4	3	4	3	4	5	10	11	11	10	11	10	20	174	283		2.356
40				3	3	4	3	4	3	8	11	10	11	10	11	10	11	51	174	327		2.365
45			1	4	3	4	3	4	9	11	11	10	11	10	11	10	15	76	174	367		2.396

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	RG	P_{DCS}
90	**msw**																					
5																			5	5	H	1.025
10															3	4	3	4	7	21	N	2.161
15											2	3	4	3	4	4	3	5	52	80		2.404
20								1	4	3	4	3	4	3	4	5	11	11	92	145		2.319
25						1	4	3	4	3	4	3	4	5	11	11	10	11	129	203		2.273
30					3	3	4	3	4	3	4	4	11	10	11	11	10	11	163	255		2.330
35				3	3	4	4	3	4	3	9	11	10	11	10	11	11	34	174	305		2.352
40			2	4	3	4	3	4	5	11	10	11	11	10	11	10	11	66	174	350		2.396
93	**msw**																					
6																		3	7	10		1.044
10														2	3	4	3	4	8	24		2.323
15										1	3	4	3	4	3	4	3	7	59	91		2.390
20								3	4	3	4	3	4	3	4	8	11	10	101	158		2.301
25						4	3	4	3	4	3	4	3	9	11	10	11	10	139	218		2.307
30				2	4	3	4	3	4	3	4	8	10	11	11	10	11	12	174	274		2.352
35			3	3	4	3	4	3	4	6	10	11	11	10	11	10	11	49	174	327		2.354
40		2	4	3	4	3	4	3	10	11	10	11	10	11	10	11	18	76	174	375		2.380
96	**msw**																					
6																	1	3	7	11		1.165
10														3	4	3	4	3	12	29		2.410
15										3	3	4	3	4	3	4	3	9	66	102		2.376
20							2	4	3	4	3	4	3	4	4	11	11	10	109	172		2.297
25					3	3	4	3	4	4	3	4	5	10	11	11	10	11	149	235		2.321
30			2	3	4	3	4	3	4	3	5	11	10	11	11	10	11	25	174	294		2.360
35		2	4	3	4	3	4	3	4	10	10	11	11	10	11	10	11	63	174	348		2.382
40	2	3	4	3	4	3	4	7	11	10	11	10	11	11	10	11	35	76	174	400		2.380

APPENDIX D XVAL-HE-9_040 1.3 ATM PO_2 $HE\text{-}O_2$ DECOMPRESSION TABLES (FSW)

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
80	**fsw**																						
86																					0	0	3.354
90																					3	3	2.992
100																					10	10	3.155
110																					17	17	3.289
120																					23	23	3.433
130																					29	29	3.551
140																					34	34	3.687
150																					39	39	3.803
160																					45	45	3.856
170																					52	52	3.849
180																					59	59	3.824
190																					65	65	3.825
200																					71	71	3.814
210																					76	76	3.835
220																					82	82	3.806
230																					87	87	3.810
240																					92	92	3.807

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
90	**fsw**																						
46																					0	0	2.539
50																					1	1	2.436
60																					2	2	2.778
70																					4	4	2.924
80																					14	14	3.070
90																					23	23	3.247
100																					31	31	3.423
110																					38	38	3.602
120																					45	45	3.750
130																					52	52	3.867
140																					61	61	3.873
150																					70	70	3.853
160																					78	78	3.860
170																					86	86	3.854
180																					93	93	3.878
190																					100	100	3.890
200																					107	107	3.891
210																					114	114	3.881
220																					120	120	3.903
230																					126	126	3.914
240																					132	132	3.917

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
100	**fsw**																						
32																					0	0	2.355
40																					2	2	2.412
50																					4	4	2.651
60																					8	8	2.886
70																					20	20	3.112
80																					31	31	3.315
90																					40	40	3.544
100																					49	49	3.726
110																					58	58	3.863
120																					69	69	3.880
130																					80	80	3.873
140																					90	90	3.890
150																					99	99	3.933
160																					109	109	3.918
170																					118	118	3.931
180																					126	126	3.971
190																					135	135	3.956
200																					143	143	3.970
210																					151	151	3.972
220																				1	157	158	4.007
230																				1	165	166	3.988
240																				1	172	173	3.999

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
110	**fsw**																						
25																					0	0	2.305
30																					2	2	2.262
40																					4	4	2.824
50																					7	7	2.978
60																				1	21	22	3.118
70																				2	33	35	3.360
80																				2	45	47	3.573
90																				3	55	58	3.769
100																				3	66	69	3.905
110																				3	80	83	3.878
120																				3	92	95	3.912
130																				3	104	107	3.924
140																				4	114	118	3.965
150																				4	125	129	3.981
160																				4	136	140	3.981
170																				4	146	150	4.011
180																				4	156	160	4.026
190																				4	165	169	4.068
200																				4	175	179	4.056
210																				5	183	188	4.071
220																				14	183	197	4.064
230																			1	22	182	205	4.089
240																			1	30	183	214	4.056

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
120	**fsw**																						
21																					0	0	2.392
30																					4	4	2.493
40																					7	7	2.937
50																				2	18	20	3.052
60																				3	33	36	3.325
70																			1	4	45	50	3.585
80																			2	4	58	64	3.764
90																			3	3	71	77	3.912
100																			3	3	87	93	3.891
110																			3	4	100	107	3.935
120																			3	4	114	121	3.947
130																			3	4	127	134	3.980
140																			4	3	140	147	4.003
150																			4	3	152	159	4.041
160																			4	3	164	171	4.062
170																			4	3	176	183	4.067
180																			4	7	183	194	4.092
190																			4	18	183	205	4.091
200																			4	28	183	215	4.115
210																			4	38	183	225	4.126
220																			4	48	183	235	4.122
230																		1	3	58	183	245	4.117
240																		1	3	67	183	254	4.124

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																				TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
130	**fsw**																						
18																					0	0	2.429
20																					1	1	2.569
30																					6	6	2.774
40																				2	10	12	2.962
50																			1	4	27	32	3.271
60																			3	4	43	50	3.511
70																		1	4	3	58	66	3.742
80																		2	3	4	72	81	3.916
90																		2	4	5	88	99	3.934
100																		3	3	6	104	116	3.944
110																		3	4	6	119	132	3.969
120																		3	4	7	133	147	3.998
130																		3	4	7	147	161	4.051
140																		4	3	7	162	176	4.056
150																		4	3	8	174	189	4.111
160																		4	3	13	183	203	4.104
170																		4	3	26	183	216	4.106
180																		4	3	38	183	228	4.132
190																		4	3	50	183	240	4.139
200																		4	3	62	183	252	4.129
210																		4	3	73	183	263	4.142
220																		4	3	84	183	274	4.141
230																	1	3	13	85	183	285	4.138
240																	1	3	23	85	183	295	4.143

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
140	**fsw**																						
15																					0	0	2.127
20																					4	4	2.039
30																				1	8	9	2.843
40																			2	3	18	23	3.139
50																		1	3	4	37	45	3.434
60																		3	3	6	52	64	3.707
70																	1	3	4	8	66	82	3.932
80																	2	3	4	10	84	103	3.929
90																	2	4	4	11	101	122	3.961
100																	3	3	6	10	118	140	4.004
110																	3	4	6	10	135	158	4.003
120																	3	4	6	11	150	174	4.046
130																	3	4	7	11	165	190	4.078
140																	3	4	7	11	180	205	4.122
150																	4	3	8	22	183	220	4.144
160																	4	3	8	37	183	235	4.136
170																	4	3	8	51	183	249	4.147
180																	4	3	8	64	183	262	4.177
190																	4	3	8	78	183	276	4.151
200																	4	3	13	86	182	288	4.181
210																	4	3	25	86	183	301	4.159
220																	4	3	37	86	183	313	4.154
230																	4	3	49	86	182	324	4.168
240																1	3	4	60	85	183	336	4.148

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
150	**fsw**																						
13																					0	0	1.977
20																					6	6	2.084
30																			1	4	9	14	2.658
40																		1	3	4	26	34	3.320
50																		3	4	7	43	57	3.657
60																	2	4	4	11	58	79	3.904
70																	4	3	8	10	78	103	3.956
80																1	4	4	9	11	97	126	3.955
90																2	4	4	10	11	115	146	4.017
100																3	3	5	11	11	133	166	4.005
110																3	4	5	11	11	150	184	4.071
120																3	4	6	11	11	167	202	4.095
130																3	4	7	11	11	183	219	4.135
140																3	4	7	11	28	182	235	4.162
150																4	3	8	10	44	183	252	4.156
160																4	3	8	11	59	182	267	4.185
170																4	3	8	11	74	183	283	4.156
180																4	3	8	14	85	183	297	4.185
190																4	3	8	28	85	183	311	4.198
200																4	3	8	42	85	183	325	4.189
210																4	3	8	56	85	183	339	4.162
220																4	3	8	69	85	183	352	4.155
230																4	3	8	81	86	183	365	4.133
240															1	3	4	16	85	86	182	377	4.145

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop 220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	P_{DCS}
160	**fsw**																						
11																					0	0	1.616
20																				2	7	9	1.945
30																			4	3	14	21	2.882
40																		3	4	6	32	45	3.494
50																	3	3	6	11	48	71	3.846
60																2	3	4	10	11	68	98	3.977
70																3	4	7	10	11	90	125	3.993
80															1	4	3	10	10	11	111	150	3.986
90															2	3	4	11	11	10	131	172	4.028
100															2	4	5	11	10	11	149	192	4.104
110															3	3	6	11	11	10	168	212	4.130
120															3	4	6	11	11	14	182	231	4.144
130															3	4	7	10	11	31	183	249	4.166
140															3	4	7	11	11	48	183	267	4.167
150															4	3	8	10	11	66	182	284	4.190
160															4	3	8	10	11	82	183	301	4.176
170															4	3	8	11	23	85	183	317	4.188
180															4	3	8	11	38	86	183	333	4.175
190															4	3	8	11	54	85	183	348	4.176
200															4	3	8	11	68	86	183	363	4.159
210															4	3	8	11	83	85	183	377	4.166
220															4	3	8	22	86	85	183	391	4.159
230															4	3	8	36	86	85	183	405	4.134
240														1	3	4	8	49	86	85	183	419	4.107

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																				TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
170	**fsw**																						
10																					0	0	1.636
20																			1	3	8	12	1.946
30																		3	4	3	17	27	3.141
40																	3	4	3	11	37	58	3.632
50																2	4	4	11	11	54	86	4.032
60															1	4	3	10	11	11	80	120	3.969
70															3	4	6	10	11	11	103	148	4.024
80														1	3	4	9	11	10	11	125	174	4.066
90														2	3	4	10	11	11	11	146	198	4.062
100														2	4	5	10	11	11	11	166	220	4.117
110														3	3	6	11	10	11	14	183	241	4.159
120														3	4	6	11	10	11	34	182	261	4.185
130														3	4	7	10	11	11	52	183	281	4.169
140														3	4	7	11	11	10	71	183	300	4.168
150														4	3	7	11	11	13	86	183	318	4.175
160														4	3	8	10	11	31	85	183	335	4.205
170														4	3	8	11	10	48	86	182	352	4.204
180														4	3	8	11	10	65	85	183	369	4.177
190														4	3	8	11	11	80	85	183	385	4.173
200														4	3	8	11	21	85	86	183	401	4.158
210														4	3	8	11	36	86	85	183	416	4.155
220														4	3	8	11	51	86	85	183	431	4.133
230														4	3	8	11	66	85	86	183	446	4.099
240													1	3	4	8	10	81	85	86	182	460	4.099

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
180	**fsw**																						
9																					0	0	1.559
10																					2	2	1.286
20																			3	4	7	14	2.139
30																	3	3	4	4	24	38	3.232
40																3	3	4	8	11	42	71	3.816
50															2	3	4	10	11	11	66	107	4.008
60														1	3	4	9	10	11	11	93	142	4.008
70														3	3	6	10	11	11	11	117	172	4.042
80													1	3	4	8	11	11	10	11	141	200	4.105
90													2	3	4	10	11	10	11	11	163	225	4.156
100													2	4	4	11	11	11	10	13	183	249	4.153
110													3	3	6	10	11	11	11	33	183	271	4.170
120													3	4	6	11	10	11	11	54	183	293	4.172
130													3	4	7	10	11	11	10	74	183	313	4.200
140													3	4	7	11	10	11	18	86	183	333	4.181
150													3	4	7	11	11	11	36	86	182	351	4.219
160													4	3	8	10	11	11	55	86	182	370	4.201
170													4	3	8	11	10	11	73	86	182	388	4.191
180													4	3	8	11	10	16	85	86	183	406	4.166
190													4	3	8	11	11	32	86	85	183	423	4.155
200													4	3	8	11	11	49	85	86	183	440	4.120
210													4	3	8	11	11	65	85	86	183	456	4.105
220													4	3	8	11	11	80	86	85	183	471	4.111
230													4	3	8	11	22	85	86	85	183	487	4.071
240													4	3	8	11	37	85	86	85	183	502	4.047

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	P_{DCS}
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	
190	**fsw**																						
8																					0	0	1.392
10																					3	3	1.397
20																		2	4	3	8	17	2.363
30																2	4	3	4	7	29	49	3.365
40															2	4	4	5	11	11	48	85	3.978
50														1	4	3	9	11	11	10	78	127	4.055
60														4	3	8	11	10	11	11	106	164	4.062
70													2	4	5	10	11	11	11	10	133	197	4.105
80													4	3	8	11	11	10	11	11	157	226	4.154
90												1	4	4	9	11	11	11	10	11	181	253	4.232
100												2	4	4	11	10	11	11	11	32	183	279	4.151
110												3	3	5	11	11	11	10	11	54	183	302	4.202
120												3	4	6	10	11	11	11	10	76	183	325	4.191
130												3	4	6	11	11	11	10	22	85	183	346	4.204
140												3	4	7	11	10	11	11	41	86	183	367	4.188
150												3	4	7	11	11	11	10	61	86	183	387	4.176
160												4	3	8	10	11	11	11	80	85	183	406	4.186
170												4	3	8	11	10	11	24	86	85	183	425	4.175
180												4	3	8	11	10	11	43	85	86	183	444	4.133
190												4	3	8	11	11	10	61	85	86	182	461	4.137
200												4	3	8	11	11	10	78	85	86	183	479	4.100
210												4	3	8	11	11	19	86	85	86	183	496	4.077
220												4	3	8	11	11	36	86	85	86	182	512	4.067
230												4	3	8	11	11	52	86	85	86	182	528	4.046
240												4	3	8	11	11	68	85	86	85	183	544	4.017

BT (min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																						
200	**fsw**																						
7																					0	0	1.133
10																					5	5	1.172
20																	1	4	3	4	11	23	2.532
30															2	3	4	4	3	11	33	60	3.522
40														2	4	3	4	10	11	11	57	102	4.043
50													1	3	4	7	11	11	10	11	90	148	4.074
60													3	4	7	10	11	11	10	11	120	187	4.143
70												2	4	4	10	11	11	11	10	11	148	222	4.183
80												3	4	7	11	11	11	10	11	11	175	254	4.187
90											1	4	3	10	11	10	11	11	11	28	183	283	4.163
100											2	4	4	10	11	11	11	10	11	52	183	309	4.217
110											3	3	5	11	11	10	11	11	11	75	183	334	4.201
120											3	3	6	11	11	11	10	11	23	85	183	357	4.224
130											3	4	6	11	11	10	11	11	45	85	183	380	4.204
140											3	4	7	11	10	11	11	11	65	86	183	402	4.181
150											3	4	7	11	11	10	11	11	86	85	183	422	4.196
160											4	3	8	10	11	11	11	31	86	85	183	443	4.171
170											4	3	8	10	11	11	11	51	85	86	183	463	4.131
180											4	3	8	11	10	11	11	70	85	86	183	482	4.119
190											4	3	8	11	10	11	14	86	85	86	182	500	4.114
200											4	3	8	11	11	10	33	85	86	85	183	519	4.068
210											4	3	8	11	11	10	50	86	85	86	183	537	4.032
220											4	3	8	11	11	10	67	86	85	86	183	554	4.017
230											4	3	8	11	11	10	84	86	85	86	183	571	3.985
240											4	3	8	11	11	25	86	85	86	85	183	587	3.971

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
210	**fsw**																						
7																					0	0	1.563
10																					6	6	1.305
20																	4	3	4	3	14	28	2.734
30														1	4	4	3	4	7	11	38	72	3.685
40													2	4	3	4	8	10	11	11	69	122	4.012
50												1	3	4	5	11	11	10	11	11	103	170	4.070
60												3	3	6	11	11	10	11	11	11	135	212	4.105
70											2	3	4	10	11	11	11	10	11	11	165	249	4.194
80											3	4	7	10	11	11	11	10	11	22	182	282	4.216
90										1	4	3	9	11	11	11	10	11	11	48	183	313	4.204
100										2	3	4	11	11	10	11	11	11	10	74	183	341	4.208
110										2	4	5	11	10	11	11	11	10	23	86	183	367	4.202
120										3	3	6	11	11	10	11	11	11	46	85	183	391	4.209
130										3	4	6	11	11	10	11	11	11	69	85	183	415	4.184
140										3	4	7	10	11	11	11	10	16	86	85	183	437	4.191
150										3	4	7	11	11	10	11	11	37	86	85	183	459	4.165
160										4	3	8	10	11	11	10	11	59	85	86	182	480	4.150
170										4	3	8	10	11	11	11	10	79	85	86	183	501	4.109
180										4	3	8	11	10	11	11	24	85	86	85	183	521	4.086
190										4	3	8	11	10	11	11	43	85	86	85	183	540	4.067
200										4	3	8	11	11	10	11	62	85	86	85	183	559	4.044
210										4	3	8	11	11	10	11	80	86	85	86	183	578	3.999
220										4	3	8	11	11	10	24	86	85	86	85	183	596	3.969
230										4	3	8	11	11	10	42	85	86	85	86	182	613	3.958
240										4	3	8	11	11	10	59	85	86	85	86	183	631	3.910

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
220	**fsw**																						
6																					0	0	1.168
10																				1	7	8	1.258
20																3	3	4	3	4	16	33	2.964
30													1	3	4	4	3	4	11	10	44	84	3.837
40												2	3	4	4	5	11	10	11	11	81	142	3.997
50											1	3	4	3	11	11	10	11	11	11	116	192	4.109
60											2	4	5	10	11	11	11	10	11	11	150	236	4.206
70										1	4	4	9	11	11	11	10	11	11	11	183	277	4.198
80										3	4	6	11	10	11	11	11	10	11	41	183	312	4.221
90									1	4	3	9	11	10	11	11	11	10	11	69	183	344	4.231
100									2	3	4	11	10	11	11	11	10	11	21	85	183	373	4.216
110									2	4	5	10	11	11	11	10	11	11	46	85	183	400	4.211
120									3	3	6	11	11	10	11	11	10	11	71	85	183	426	4.194
130									3	4	6	11	10	11	11	11	10	19	86	85	183	450	4.193
140									3	4	7	10	11	11	11	10	11	42	86	85	183	474	4.153
150									3	4	7	11	11	10	11	11	11	63	86	85	183	496	4.144
160									4	3	7	11	11	11	10	11	11	85	86	85	183	518	4.118
170									4	3	8	10	11	11	11	10	32	86	85	86	183	540	4.071
180									4	3	8	11	10	11	11	11	52	86	85	86	182	560	4.063
190									4	3	8	11	10	11	11	11	72	86	85	86	182	580	4.036
200									4	3	8	11	11	10	11	18	85	86	85	86	182	600	4.000
210									4	3	8	11	11	10	11	37	85	86	85	86	183	620	3.948
220									4	3	8	11	11	10	11	55	86	85	86	85	183	638	3.939
230									4	3	8	11	11	10	11	74	85	86	85	86	183	657	3.889
240									4	3	8	11	11	10	17	86	85	86	85	86	183	675	3.853

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
230	**fsw**																						
6																					0	0	1.568
10																				3	7	10	1.198
20															2	3	4	3	4	4	20	40	3.139
30													4	3	4	3	4	8	10	11	50	97	3.983
40											1	4	4	3	4	10	10	11	11	11	92	161	4.037
50											4	3	4	8	11	11	11	10	11	11	131	215	4.126
60										2	3	4	11	11	10	11	11	11	10	11	167	262	4.261
70									1	4	3	9	11	11	11	10	11	11	11	29	183	305	4.207
80									3	3	6	11	11	10	11	11	11	10	11	61	183	342	4.239
90								1	3	4	8	11	11	11	10	11	11	11	15	86	183	376	4.199
100								2	3	4	10	11	11	10	11	11	11	10	44	85	183	406	4.227
110								2	4	4	11	11	11	10	11	11	11	10	70	86	182	434	4.215
120								3	3	6	11	10	11	11	11	10	11	20	86	85	183	461	4.195
130								3	4	6	11	10	11	11	11	10	11	45	86	85	183	487	4.155
140								3	4	7	10	11	11	11	10	11	11	68	86	85	183	511	4.135
150								3	4	7	11	11	10	11	11	10	17	86	85	86	182	534	4.117
160								4	3	7	11	11	11	10	11	11	39	85	86	85	183	557	4.077
170								4	3	8	10	11	11	11	10	11	61	85	86	85	183	579	4.051
180								4	3	8	11	10	11	11	11	10	82	86	85	86	183	601	4.004
190								4	3	8	11	10	11	11	11	28	85	86	85	86	183	622	3.964
200								4	3	8	11	11	10	11	11	48	86	85	86	85	183	642	3.949
210								4	3	8	11	11	10	11	11	68	86	85	86	85	183	662	3.912
220								4	3	8	11	11	10	11	13	86	85	86	85	86	182	681	3.888
230								4	3	8	11	11	10	11	32	85	86	85	86	85	183	700	3.862
240								4	3	8	11	11	10	11	51	85	86	85	86	85	183	719	3.821

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
240	**fsw**																						
5																					0	0	1.038
10																			1	3	8	12	1.280
20														1	3	4	4	3	4	4	26	49	3.263
30												3	4	3	4	3	5	10	11	11	60	114	3.968
40										1	4	3	4	4	7	11	10	11	11	11	105	182	4.041
50										4	3	4	6	11	11	11	10	11	11	11	146	239	4.143
60									2	3	4	10	10	11	11	10	11	11	11	12	183	289	4.243
70								1	3	4	8	11	11	11	10	11	11	10	11	49	183	334	4.258
80								3	3	5	11	11	11	10	11	11	11	10	11	82	183	373	4.242
90							1	3	4	8	11	10	11	11	11	10	11	11	38	85	183	408	4.236
100							2	3	4	10	11	10	11	11	11	10	11	11	67	85	183	440	4.206
110							2	4	4	11	11	10	11	11	11	10	11	19	86	85	183	469	4.204
120							3	3	6	10	11	11	11	10	11	11	11	45	86	85	183	497	4.167
130							3	4	6	10	11	11	11	10	11	11	11	71	85	86	182	523	4.145
140							3	4	6	11	11	11	10	11	11	11	20	86	85	86	183	549	4.089
150							3	4	7	11	10	11	11	11	10	11	45	85	86	85	183	573	4.062
160							3	4	7	11	11	11	10	11	11	11	67	85	86	85	183	596	4.044
170							4	3	8	10	11	11	11	10	11	16	85	86	85	86	182	619	4.008
180							4	3	8	11	10	11	11	11	10	38	85	86	85	86	183	642	3.954
190							4	3	8	11	10	11	11	11	10	59	86	85	86	85	183	663	3.934
200							4	3	8	11	11	10	11	11	10	80	86	85	86	85	183	684	3.902
210							4	3	8	11	11	10	11	11	25	86	85	86	85	86	183	705	3.859
220							4	3	8	11	11	10	11	11	45	86	85	86	85	86	183	725	3.833
230							4	3	8	11	11	10	11	11	65	86	85	86	85	86	183	745	3.791
240							4	3	8	11	11	10	11	11	84	86	85	86	85	86	183	764	3.763

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
250	**fsw**																						
5																					0	0	1.399
10																			2	4	7	13	1.432
20														3	4	3	4	3	4	7	30	58	3.380
30											3	3	4	3	4	4	8	10	11	11	71	132	3.948
40									1	4	3	4	3	5	11	11	10	11	11	11	118	203	4.052
50									3	4	4	4	11	11	11	10	11	11	11	10	162	263	4.215
60								1	4	4	8	11	11	10	11	11	10	11	11	31	183	317	4.246
70								4	3	8	11	10	11	11	11	10	11	11	11	68	183	363	4.264
80							2	4	5	10	11	11	11	10	11	11	11	10	29	86	182	404	4.267
90							4	3	8	11	11	10	11	11	10	11	11	11	61	85	183	441	4.221
100						1	4	4	9	11	11	11	10	11	11	11	10	17	85	86	182	474	4.214
110						2	4	4	11	10	11	11	11	10	11	11	11	44	86	85	183	505	4.170
120						3	3	5	11	11	11	10	11	11	11	10	11	72	85	86	183	534	4.127
130						3	4	6	10	11	11	11	10	11	11	11	23	86	85	86	182	561	4.109
140						3	4	6	11	11	11	10	11	11	11	10	49	85	86	85	183	587	4.067
150						3	4	7	11	10	11	11	11	10	11	11	73	85	86	85	183	612	4.032
160						3	4	7	11	11	11	10	11	11	10	23	85	86	85	86	182	636	3.998
170						4	3	8	10	11	11	11	10	11	11	45	86	85	86	85	183	660	3.957
180						4	3	8	11	10	11	11	10	11	11	68	85	86	85	86	183	683	3.916
190						4	3	8	11	10	11	11	11	10	16	85	86	85	86	85	183	705	3.883
200						4	3	8	11	11	10	11	11	10	37	86	85	86	85	86	183	727	3.85
210						4	3	8	11	11	10	11	11	11	58	85	86	85	86	85	183	748	3.821
220						4	3	8	11	11	10	11	11	11	78	86	85	86	85	86	183	769	3.778
230						4	3	8	11	11	10	11	11	24	86	85	86	85	85	86	183	789	3.758
240						4	3	8	11	11	10	11	11	44	86	85	86	85	86	85	183	809	3.725

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
260	**fsw**																						
10																		1	3	4	7	15	1.575
20													2	4	3	4	3	4	4	9	35	68	3.486
30										2	4	3	4	3	4	5	10	11	11	11	81	149	3.959
40								1	3	4	3	4	4	9	11	11	10	11	11	10	132	224	4.104
50								3	4	4	3	10	11	11	10	11	11	11	10	11	179	289	4.213
60							1	4	4	7	10	11	11	11	10	11	11	11	10	50	183	345	4.278
70							3	4	7	11	10	11	11	11	10	11	11	11	14	86	183	394	4.257
80						2	4	4	11	10	11	11	11	10	11	11	11	10	52	85	183	437	4.242
90						4	3	8	10	11	11	10	11	11	11	10	11	11	85	85	183	475	4.214
100					1	4	3	10	11	11	10	11	11	11	10	11	11	41	86	85	183	510	4.173
110					2	4	4	10	11	11	11	10	11	11	11	10	11	71	85	86	183	542	4.133
120					3	3	5	11	11	11	10	11	11	10	11	11	24	86	85	86	182	571	4.114
130					3	3	6	11	11	11	10	11	11	11	10	11	51	85	86	85	183	599	4.073
140					3	4	6	11	11	10	11	11	11	10	11	11	77	85	86	85	183	626	4.030
150					3	4	7	11	10	11	11	11	10	11	11	27	86	85	86	85	183	652	3.989
160					3	4	7	11	11	10	11	11	11	10	11	52	85	86	85	86	183	677	3.945
170					4	3	8	10	11	11	11	10	11	11	10	76	86	85	86	85	183	701	3.919
180					4	3	8	11	10	11	11	10	11	11	24	86	85	86	85	86	183	725	3.869
190					4	3	8	11	10	11	11	11	10	11	47	86	85	86	85	86	183	748	3.835
200					4	3	8	11	10	11	11	11	10	11	70	85	86	85	86	85	183	770	3.803
210					4	3	8	11	11	10	11	11	11	16	85	86	85	86	85	86	183	792	3.772
220					4	3	8	11	11	10	11	11	11	37	86	85	86	85	86	85	183	813	3.750
230					4	3	8	11	11	10	11	11	11	58	86	85	86	85	86	85	183	834	3.714
240					4	3	8	11	11	10	11	11	11	78	86	85	86	85	86	85	183	854	3.695

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
270	**fsw**																						
10																		2	4	4	7	17	1.729
20												1	4	3	4	4	3	4	5	10	40	78	3.619
30									2	3	4	3	4	4	3	8	11	11	11	10	92	166	4.000
40								4	3	4	3	4	7	11	10	11	11	11	10	11	146	246	4.115
50							3	4	3	4	8	11	11	10	11	11	11	10	11	24	183	315	4.221
60						1	4	4	5	11	11	10	11	11	11	10	11	11	11	69	183	374	4.266
70						3	4	6	11	10	11	11	11	10	11	11	11	10	37	85	183	425	4.277
80					2	3	4	11	11	10	11	11	11	10	11	11	11	10	75	85	183	470	4.229
90					3	4	7	11	10	11	11	11	10	11	11	11	10	35	85	86	183	510	4.188
100				1	4	3	10	10	11	11	11	10	11	11	11	10	11	67	85	86	183	546	4.143
110				2	4	3	11	11	11	10	11	11	11	10	11	11	22	86	85	86	183	579	4.099
120				2	4	5	11	11	10	11	11	11	10	11	11	11	51	85	86	85	183	609	4.077
130				3	3	6	11	11	11	10	11	11	11	10	11	11	79	86	85	86	182	638	4.033
140				3	4	6	11	11	10	11	11	11	10	11	11	31	86	85	86	85	183	666	3.977
150				3	4	7	11	10	11	11	10	11	11	11	10	57	86	85	86	85	183	692	3.953
160				3	4	7	11	11	10	11	11	11	10	11	11	82	86	85	86	85	183	718	3.896
170				4	3	8	10	11	11	10	11	11	11	10	32	86	85	86	85	86	183	743	3.863
180				4	3	8	10	11	11	11	10	11	11	11	56	85	86	85	86	85	183	767	3.828
190				4	3	8	11	10	11	11	11	10	11	11	79	86	85	86	85	86	183	791	3.783
200				4	3	8	11	10	11	11	11	10	11	28	85	86	85	86	85	86	182	813	3.773
210				4	3	8	11	11	10	11	11	11	10	50	86	85	86	85	86	85	183	836	3.732
220				4	3	8	11	11	10	11	11	11	10	72	86	85	86	85	86	85	183	858	3.696
230				4	3	8	11	11	10	11	11	11	18	86	85	86	85	86	85	86	182	879	3.680
240				4	3	8	11	11	10	11	11	11	39	86	85	86	85	86	85	86	182	900	3.651

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
280	**fsw**																						
10																	1	3	4	3	8	19	1.884
20												3	4	4	3	4	3	4	8	11	44	88	3.749
30								1	4	3	4	3	4	4	4	11	11	10	11	11	103	184	3.994
40							3	4	4	3	4	4	11	11	10	11	11	10	11	11	160	268	4.169
50						3	4	3	4	6	11	11	10	11	11	10	11	11	11	41	183	341	4.252
60					1	4	3	5	10	11	11	11	10	11	11	11	10	11	15	85	183	403	4.287
70					3	3	6	11	10	11	11	10	11	11	11	10	11	11	58	86	183	457	4.249
80				2	3	4	10	11	11	10	11	11	11	10	11	11	11	23	85	86	183	504	4.212
90				3	4	6	11	11	11	10	11	11	11	10	11	11	11	59	86	85	183	545	4.164
100			1	4	3	9	11	11	11	10	11	11	11	10	11	11	18	86	85	86	183	583	4.106
110			2	3	4	11	11	10	11	11	11	10	11	11	11	10	50	86	85	86	182	616	4.077
120			2	4	5	11	10	11	11	11	10	11	11	11	10	11	80	85	86	85	183	648	4.023
130			3	3	6	11	11	10	11	11	11	10	11	11	11	33	85	86	85	86	183	678	3.969
140			3	4	6	11	11	10	11	11	11	10	11	11	10	61	86	85	86	85	183	706	3.945
150			3	4	7	10	11	11	11	10	11	11	11	10	13	85	86	85	86	85	183	733	3.897
160			3	4	7	11	11	10	11	11	11	10	11	11	38	85	86	85	86	85	183	759	3.871
170			4	3	7	11	11	11	10	11	11	11	10	11	64	85	86	85	86	85	183	785	3.817
180			4	3	8	10	11	11	11	10	11	11	11	13	85	86	85	86	85	86	183	810	3.776
190			4	3	8	11	10	11	11	11	10	11	11	37	86	85	86	85	86	85	183	834	3.752
200			4	3	8	11	10	11	11	11	10	11	11	61	85	86	85	86	85	86	183	858	3.704
210			4	3	8	11	11	10	11	11	11	10	11	84	85	86	85	86	85	86	183	881	3.680
220			4	3	8	11	11	10	11	11	11	10	32	86	85	86	85	86	85	85	183	903	3.660
230			4	3	8	11	11	10	11	11	11	10	54	85	86	85	86	85	86	85	183	925	3.630
240			4	3	8	11	11	10	11	11	11	10	75	86	85	86	85	86	85	86	183	947	3.598

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
290	**fsw**																						
10																	2	4	3	4	7	20	2.091
20											2	4	4	3	4	3	4	4	10	11	49	98	3.882
30							1	3	4	3	4	4	3	4	8	11	11	10	11	11	115	203	4.007
40						3	4	3	4	4	3	9	11	10	11	11	11	10	11	11	176	292	4.172
50					3	4	3	4	4	11	10	11	11	11	10	11	11	11	10	60	183	368	4.262
60				1	4	3	4	10	11	10	11	11	11	10	11	11	11	10	36	85	183	433	4.300
70				2	4	5	10	11	11	11	10	11	11	11	10	11	11	11	80	86	183	489	4.253
80			1	4	4	9	11	11	11	10	11	11	11	10	11	11	11	47	86	85	183	538	4.205
90			3	4	6	11	10	11	11	11	10	11	11	11	10	11	11	85	86	85	183	581	4.145
100		1	4	3	9	11	10	11	11	11	10	11	11	11	10	11	46	85	86	85	183	620	4.075
110		2	3	4	11	10	11	11	11	10	11	11	11	10	11	11	77	86	85	86	183	655	4.029
120		2	4	5	10	11	11	11	10	11	11	11	10	11	11	33	86	85	86	85	183	687	3.987
130		3	3	6	11	11	10	11	11	10	11	11	11	10	11	63	85	86	85	86	183	718	3.935
140		3	4	6	11	10	11	11	11	10	11	11	11	10	17	85	86	85	86	85	183	747	3.889
150		3	4	7	10	11	11	11	10	11	11	11	10	11	43	86	85	86	85	86	183	775	3.853
160		3	4	7	11	11	10	11	11	11	10	11	11	11	69	86	85	86	85	86	183	802	3.807
170		4	3	7	11	11	11	10	11	11	11	10	11	21	85	86	85	86	85	86	183	828	3.773
180		4	3	8	10	11	11	11	10	11	11	11	10	46	86	85	86	85	86	85	183	853	3.747
190		4	3	8	11	10	11	11	11	10	11	11	11	70	86	85	86	85	86	85	183	878	3.709
200		4	3	8	11	10	11	11	11	10	11	11	20	85	86	85	86	85	86	85	183	902	3.680
210		4	3	8	11	11	10	11	11	10	11	11	44	85	86	85	86	85	86	85	183	926	3.642
220		4	3	8	11	11	10	11	11	11	10	11	67	85	86	85	86	85	86	85	183	949	3.617
230		4	3	8	11	11	10	11	11	11	10	15	85	86	85	86	85	86	85	86	183	972	3.583
240		4	3	8	11	11	10	11	11	11	10	37	85	86	85	86	85	86	85	86	183	994	3.557

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
300	**fsw**																						
10																1	3	4	3	4	7	22	2.287
20										2	3	4	3	4	3	4	4	6	11	11	56	111	3.934
30							3	4	3	4	4	3	4	5	11	11	10	11	11	11	126	221	4.054
40					3	3	4	4	3	4	6	11	11	10	11	11	11	10	11	20	182	315	4.225
50				3	3	4	4	3	10	10	11	11	11	10	11	11	11	10	11	79	183	396	4.258
60			1	4	3	4	8	11	11	11	10	11	11	11	10	11	11	11	57	85	183	464	4.274
70			2	4	4	10	11	11	11	10	11	11	11	10	11	11	11	29	86	85	183	522	4.251
80		1	4	3	10	10	11	11	11	10	11	11	11	10	11	11	11	72	86	85	183	573	4.181
90		3	3	6	11	11	11	10	11	11	11	10	11	11	11	10	37	86	85	86	183	618	4.097
100	1	3	4	9	10	11	11	11	10	11	11	10	11	11	11	10	73	86	85	86	183	658	4.034
110	2	3	4	10	11	11	11	10	11	11	11	10	11	11	10	32	85	86	85	86	183	694	3.98
120	2	4	5	10	11	11	10	11	11	11	10	11	11	11	10	63	85	86	85	86	183	727	3.938
130	3	3	6	11	10	11	11	11	10	11	11	11	10	11	18	86	85	86	85	86	183	759	3.876
140	3	4	6	11	10	11	11	11	10	11	11	11	10	11	47	86	85	86	85	86	182	788	3.860
150	3	4	7	10	11	11	11	10	11	11	11	10	11	11	75	85	86	85	86	85	183	817	3.804
160	3	4	7	11	11	10	11	11	11	10	11	11	10	27	86	85	86	85	86	85	183	844	3.779
170	4	3	7	11	11	11	10	11	11	11	10	11	11	53	86	85	86	85	86	85	183	871	3.733
180	4	3	8	10	11	11	11	10	11	11	11	10	11	79	86	85	86	85	86	85	183	897	3.698
190	4	3	8	11	10	11	11	11	10	11	11	10	30	86	85	86	85	86	85	86	183	923	3.656
200	4	3	8	11	10	11	11	11	10	11	11	11	54	85	86	85	86	85	86	85	183	947	3.633
210	4	3	8	11	11	10	11	11	10	11	11	11	78	85	86	85	86	85	86	85	183	971	3.613
220	4	3	8	11	11	10	11	11	11	10	11	27	86	85	86	85	86	85	86	85	183	995	3.580
230	4	3	8	11	11	10	11	11	11	10	11	50	86	85	86	85	86	85	86	85	183	1018	3.555
240	4	3	8	11	11	10	11	11	11	10	11	73	85	86	85	86	85	86	85	86	183	1041	3.526

APPENDIX E XVAL-HE-9_040 1.3 ATM PO_2 HE-O_2 DECOMPRESSION TABLES (MSW)

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																				TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
24	**msw**																						
90																					0	0	3.248
100																					8	8	3.040
110																					14	14	3.200
120																					20	20	3.332
130																					26	26	3.44
140																					31	31	3.566
150																					35	35	3.713
160																					40	40	3.800
170																					47	47	3.785
180																					53	53	3.795
190																					59	59	3.789
200																					65	65	3.769
210																					71	71	3.740
220																					76	76	3.744
230																					81	81	3.741
240																					86	86	3.730

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
27	**msw**																						
50																					0	0	2.576
60																					1	1	2.853
70																					2	2	3.131
80																					11	11	3.005
90																					20	20	3.167
100																					28	28	3.329
110																					35	35	3.497
120																					42	42	3.632
130																					48	48	3.781
140																					56	56	3.819
150																					65	65	3.789
160																					73	73	3.785
170																					80	80	3.810
180																					88	88	3.781
190																					94	94	3.825
200																					101	101	3.816
210																					108	108	3.797
220																					114	114	3.809
230																					120	120	3.812
240																					126	126	3.806

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
30	**msw**																						
34																					0	0	2.349
40																					2	2	2.155
50																					3	3	2.698
60																					5	5	2.935
70																					17	17	3.046
80																					28	28	3.231
90																					37	37	3.444
100																					46	46	3.612
110																					55	55	3.737
120																					64	64	3.826
130																					75	75	3.805
140																					85	85	3.808
150																					94	94	3.838
160																					103	103	3.853
170																					112	112	3.854
180																					120	120	3.882
190																					128	128	3.897
200																					136	136	3.900
210																					144	144	3.892
220																					151	151	3.914
230																					158	158	3.925
240																					165	165	3.926

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
33	**msw**																						
26																					0	0	2.236
30																					1	1	2.452
40																					4	4	2.534
50																					6	6	2.950
60																					19	19	3.048
70																				1	31	32	3.277
80																				2	42	44	3.471
90																				2	53	55	3.647
100																				3	62	65	3.819
110																				3	75	78	3.819
120																				3	87	90	3.837
130																				3	98	101	3.877
140																				3	109	112	3.898
150																				3	120	123	3.902
160																				3	131	134	3.890
170																				3	141	144	3.906
180																				3	150	153	3.950
190																				3	160	163	3.940
200																				3	169	172	3.957
210																				3	178	181	3.962
220																				10	179	189	3.985
230																				18	179	197	3.994
240																				26	179	205	3.991

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
36	**msw**																						
22																					0	0	2.387
30																					3	3	2.642
40																					6	6	2.961
50																				2	15	17	2.984
60																				3	30	33	3.236
70																			1	3	43	47	3.479
80																			2	3	55	60	3.681
90																			2	4	67	73	3.820
100																			2	4	81	87	3.865
110																			3	3	96	102	3.852
120																			3	3	109	115	3.891
130																			3	4	121	128	3.911
140																			3	4	134	141	3.908
150																			3	4	146	153	3.933
160																			3	4	157	164	3.981
170																			3	4	169	176	3.974
180																			3	4	180	187	3.991
190																			3	15	179	197	4.019
200																			3	25	179	207	4.031
210																			3	35	179	217	4.031
220																			3	45	179	227	4.017
230																			3	54	179	236	4.028
240																			3	63	179	245	4.027

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
39	**msw**																						
18																					0	0	2.154
20																					1	1	2.276
30																					6	6	2.462
40																				2	8	10	2.96
50																			1	4	25	30	3.147
60																			3	3	41	47	3.404
70																		1	3	4	55	63	3.625
80																		1	4	3	69	77	3.821
90																		2	3	4	85	94	3.846
100																		2	4	4	100	110	3.89
110																		3	3	5	115	126	3.897
120																		3	3	6	129	141	3.913
130																		3	3	6	143	155	3.951
140																		3	4	6	156	169	3.979
150																		3	4	6	169	182	4.019
160																		3	4	9	179	195	4.039
170																		3	4	22	179	208	4.028
180																		3	4	34	179	220	4.040
190																		3	4	45	180	232	4.037
200																		3	4	57	179	243	4.054
210																		3	4	68	179	254	4.057
220																		3	4	79	179	265	4.045
230																		3	9	84	180	276	4.020
240																		3	19	84	180	286	4.017

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
42	**msw**																						
16																					0	0	2.281
20																					3	3	2.210
30																				1	7	8	2.866
40																			1	4	16	21	3.035
50																			4	3	34	41	3.364
60																		2	4	4	51	61	3.577
70																		3	4	7	63	77	3.856
80																	1	4	3	9	81	98	3.843
90																	2	3	4	10	97	116	3.892
100																	2	4	4	11	113	134	3.910
110																	3	3	5	11	129	151	3.932
120																	3	3	6	10	145	167	3.974
130																	3	3	6	11	159	182	4.026
140																	3	4	6	10	175	198	4.031
150																	3	4	6	20	180	213	4.030
160																	3	4	6	34	180	227	4.047
170																	3	4	6	48	180	241	4.045
180																	3	4	6	62	179	254	4.061
190																	3	4	6	75	179	267	4.060
200																	3	4	9	84	180	280	4.045
210																	3	4	21	84	180	292	4.047
220																	3	4	33	84	179	303	4.068
230																	3	4	44	84	180	315	4.040
240																	3	4	55	85	179	326	4.030

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
45	**msw**																						
13																					0	0	1.738
20																					6	6	1.816
30																				4	8	12	2.636
40																			3	4	24	31	3.236
50																		3	4	5	42	54	3.523
60																	2	3	4	10	56	75	3.789
70																	3	4	6	10	74	97	3.887
80																1	3	4	8	11	93	120	3.863
90																2	3	4	10	10	111	140	3.906
100																2	4	4	10	11	128	159	3.931
110																2	4	5	10	11	145	177	3.971
120																3	3	5	11	11	161	194	4.022
130																3	3	6	11	10	178	211	4.050
140																3	4	5	11	25	180	228	4.037
150																3	4	6	10	41	179	243	4.087
160																3	4	6	11	55	180	259	4.068
170																3	4	6	11	70	180	274	4.066
180																3	4	6	12	84	179	288	4.082
190																3	4	6	26	84	179	302	4.083
200																3	4	6	39	84	180	316	4.065
210																3	4	6	53	84	179	329	4.062
220																3	4	6	65	85	179	342	4.044
230																3	4	6	78	84	179	354	4.046
240																3	4	12	84	84	179	366	4.037

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
48	**msw**																						
12																					0	0	1.918
20																				1	7	8	1.995
30																			3	4	12	19	2.782
40																		3	3	5	31	42	3.378
50																	2	4	5	10	47	68	3.696
60																1	4	3	10	10	65	93	3.879
70																3	3	6	10	11	86	119	3.873
80															1	3	4	8	10	11	106	143	3.897
90															1	4	4	9	11	10	125	164	3.957
100															2	4	3	11	10	11	144	185	3.961
110															2	4	4	11	11	10	162	204	4.015
120															3	3	5	11	10	12	179	223	4.038
130															3	3	6	11	10	29	179	241	4.056
140															3	3	6	11	11	45	179	258	4.076
150															3	4	6	10	11	62	179	275	4.088
160															3	4	6	10	11	78	180	292	4.063
170															3	4	6	11	20	84	179	307	4.100
180															3	4	6	11	35	84	180	323	4.079
190															3	4	6	11	50	85	179	338	4.070
200															3	4	6	11	65	84	180	353	4.045
210															3	4	6	11	79	84	180	367	4.041
220															3	4	6	20	84	84	180	381	4.024
230															3	4	6	33	85	84	179	394	4.021
240															3	4	6	46	85	84	179	407	4.003

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																						
51	**msw**																						
10																					0	0	1.423
20																				3	7	10	2.098
30																		3	3	4	16	26	2.992
40																	2	4	3	10	35	54	3.550
50																2	3	4	10	11	52	82	3.898
60															1	3	4	8	11	10	76	113	3.917
70															2	4	5	10	11	11	98	141	3.915
80															4	3	8	10	11	10	120	166	3.963
90														1	4	3	10	10	11	10	141	190	3.975
100														2	3	4	10	11	11	10	161	212	3.995
110														2	4	4	11	10	11	11	180	233	4.028
120														3	3	5	11	10	11	30	179	252	4.082
130														3	3	6	10	11	11	48	179	271	4.096
140														3	3	6	11	10	11	66	180	290	4.078
150														3	4	6	10	11	10	85	179	308	4.085
160														3	4	6	10	11	27	85	179	325	4.096
170														3	4	6	11	10	45	84	179	342	4.086
180														3	4	6	11	10	61	84	179	358	4.084
190														3	4	6	11	10	77	84	179	374	4.069
200														3	4	6	11	18	84	84	180	390	4.046
210														3	4	6	11	33	84	85	179	405	4.034
220														3	4	6	11	48	84	84	180	420	4.006
230														3	4	6	11	62	85	84	179	434	3.993
240														3	4	6	11	76	84	85	179	448	3.970

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
54	**msw**																						
9																					0	0	1.353
10																					1	1	1.498
20																			2	4	7	13	2.085
30																	2	4	3	4	21	34	3.178
40																2	4	3	7	11	40	67	3.695
50															1	4	3	9	11	10	62	100	3.962
60															4	3	8	10	11	10	88	134	3.947
70														2	4	4	11	10	11	10	112	164	3.966
80														3	4	7	11	10	11	10	135	191	3.996
90													1	4	3	9	11	10	11	10	157	216	4.042
100													2	3	4	10	11	10	11	10	179	240	4.044
110													2	4	4	11	10	11	10	31	179	262	4.062
120													3	3	5	11	10	11	10	51	179	283	4.081
130													3	3	6	10	11	10	11	70	179	303	4.085
140													3	3	6	11	10	11	15	84	179	322	4.101
150													3	4	6	10	11	10	34	84	179	341	4.108
160													3	4	6	10	11	11	51	84	180	360	4.067
170													3	4	6	11	10	11	69	84	179	377	4.080
180													3	4	6	11	10	13	84	84	179	394	4.078
190													3	4	6	11	10	30	84	84	179	411	4.056
200													3	4	6	11	10	46	84	84	180	428	4.015
210													3	4	6	11	10	62	84	84	180	444	3.991
220													3	4	6	11	10	77	84	85	179	459	3.988
230													3	4	6	11	19	84	84	84	179	474	3.972
240													3	4	6	11	33	85	84	84	179	489	3.941

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																						
57	**msw**																						
8																					0	0	1.199
10																					3	3	1.192
20																		2	3	4	7	16	2.255
30																2	3	4	3	6	27	45	3.282
40															2	3	4	5	10	11	46	81	3.840
50														1	3	4	7	11	10	11	73	120	3.962
60														3	4	6	11	10	11	10	101	156	3.974
70													2	3	4	11	10	11	10	11	126	188	3.986
80													3	4	6	11	10	11	11	10	151	217	4.026
90												1	4	3	9	10	11	10	11	10	175	244	4.069
100												2	3	4	10	10	11	10	11	28	180	269	4.053
110												2	4	4	10	11	10	11	11	49	180	292	4.078
120												2	4	5	10	11	11	10	11	71	179	314	4.091
130												3	3	6	10	11	10	11	18	84	179	335	4.107
140												3	3	6	11	10	11	10	38	84	180	356	4.081
150												3	4	5	11	11	10	11	57	84	180	376	4.064
160												3	4	6	10	11	10	11	76	84	180	395	4.056
170												3	4	6	11	10	11	21	84	84	179	413	4.070
180												3	4	6	11	10	11	39	84	84	179	431	4.052
190												3	4	6	11	10	11	56	84	85	179	449	4.013
200												3	4	6	11	10	11	73	84	85	179	466	3.998
210												3	4	6	11	10	17	84	84	85	179	483	3.967
220												3	4	6	11	10	33	85	84	84	179	499	3.951
230												3	4	6	11	10	49	84	85	84	179	515	3.923
240												3	4	6	11	11	64	84	84	84	180	531	3.888

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																						
60	**msw**																						
8																					0	0	1.663
10																					4	4	1.293
20																	1	3	4	3	10	21	2.441
30															1	4	3	4	3	10	31	56	3.422
40														2	3	4	3	10	10	11	53	96	3.971
50														3	4	6	11	10	11	10	85	140	3.996
60													3	3	6	10	11	10	11	11	114	179	3.981
70												2	3	4	10	10	11	10	11	10	143	214	4.001
80												3	4	6	10	11	10	11	10	11	168	244	4.066
90											1	3	4	8	11	10	11	10	11	24	180	273	4.050
100											2	3	4	9	11	11	10	11	10	48	180	299	4.076
110											2	4	3	11	11	10	11	10	11	71	179	323	4.095
120											2	4	5	10	11	10	11	10	20	84	179	346	4.107
130											3	3	5	11	11	10	11	10	41	84	179	368	4.115
140											3	3	6	11	10	11	10	11	61	84	180	390	4.080
150											3	4	5	11	11	10	11	10	82	84	179	410	4.091
160											3	4	6	10	11	10	11	28	84	84	179	430	4.077
170											3	4	6	10	11	11	10	47	84	85	179	450	4.032
180											3	4	6	11	10	11	10	66	84	84	180	469	4.011
190											3	4	6	11	10	11	10	85	84	84	179	487	3.997
200											3	4	6	11	10	11	28	85	84	84	179	505	3.970
210											3	4	6	11	10	11	46	84	84	84	180	523	3.928
220											3	4	6	11	10	11	63	84	84	84	180	540	3.905
230											3	4	6	11	10	11	80	84	84	84	180	557	3.866
240											3	4	6	11	11	22	84	84	84	84	180	573	3.847

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
63	**msw**																						
7																					0	0	1.358
10																					6	6	1.109
20																	3	4	3	4	12	26	2.639
30														1	3	4	3	4	6	11	36	68	3.557
40													1	4	3	4	7	10	11	11	64	115	3.952
50													3	4	4	11	10	11	10	11	97	161	4.010
60												2	4	4	11	11	10	11	10	11	129	203	3.997
70											1	4	3	10	10	11	10	11	10	11	158	239	4.067
80											3	3	6	10	11	11	10	11	10	18	179	272	4.076
90										1	3	4	8	10	11	10	11	10	11	43	180	302	4.090
100										1	4	3	10	11	10	11	10	11	10	69	179	329	4.105
110										2	4	3	11	10	11	10	11	11	18	84	180	355	4.093
120										2	4	4	11	11	10	11	10	11	42	84	179	379	4.103
130										3	3	5	11	10	11	11	10	11	64	84	179	402	4.094
140										3	3	6	10	11	11	10	11	12	84	84	179	424	4.090
150										3	3	6	11	11	10	11	10	33	85	84	179	446	4.060
160										3	4	6	10	11	10	11	11	53	85	84	179	467	4.029
170										3	4	6	10	11	11	10	11	73	85	84	179	487	4.014
180										3	4	6	11	10	11	10	20	84	85	84	179	507	3.981
190										3	4	6	11	10	11	10	39	85	84	84	179	526	3.953
200										3	4	6	11	10	11	11	57	84	84	84	180	545	3.920
210										3	4	6	11	10	11	11	75	84	85	84	179	563	3.895
220										3	4	6	11	10	11	20	84	84	85	84	179	581	3.859
230										3	4	6	11	10	11	37	85	84	84	84	179	598	3.842
240										3	4	6	11	11	10	54	84	85	84	84	179	615	3.814

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
66	**msw**																						
6																					0	0	0.994
10																					7	7	1.246
20																2	4	3	4	3	16	32	2.814
30														3	4	4	3	4	10	10	41	79	3.737
40												1	4	3	4	4	11	10	11	10	76	134	3.937
50												3	4	3	10	10	11	10	11	10	111	183	4.025
60											2	3	4	11	10	11	10	11	10	11	144	227	4.056
70										1	3	4	9	10	11	10	11	10	11	11	175	266	4.090
80										3	3	5	11	10	11	10	11	11	10	36	180	301	4.079
90										4	3	8	10	11	10	11	11	10	11	63	180	332	4.094
100									1	4	3	10	10	11	10	11	11	10	16	84	180	361	4.098
110									2	3	4	11	10	11	10	11	10	11	41	84	180	388	4.083
120									2	4	4	11	10	11	11	10	11	10	65	85	179	413	4.076
130									3	3	5	11	10	11	10	11	11	14	84	84	180	437	4.070
140									3	3	6	10	11	11	10	11	10	38	84	84	179	460	4.059
150									3	3	6	11	10	11	11	10	11	59	84	84	179	482	4.036
160									3	4	6	10	11	10	11	10	11	81	84	84	179	504	4.007
170									3	4	6	10	11	11	10	11	28	84	84	84	179	525	3.980
180									3	4	6	11	10	11	10	11	48	84	84	84	180	546	3.935
190									3	4	6	11	10	11	10	11	68	84	84	84	180	566	3.901
200									3	4	6	11	10	11	10	14	84	85	84	84	179	585	3.877
210									3	4	6	11	10	11	11	32	84	84	85	84	179	604	3.845
220									3	4	6	11	10	11	11	50	85	84	84	84	179	622	3.831
230									3	4	6	11	10	11	11	69	84	84	84	84	180	641	3.776
240									3	4	6	11	11	10	13	85	84	84	84	84	180	659	3.736

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
69	**msw**																						
6																					0	0	1.363
10																				2	7	9	1.213
20															1	4	3	4	3	4	18	37	3.046
30													3	4	3	4	3	7	10	11	47	92	3.862
40											1	3	4	4	3	9	10	11	11	10	87	153	3.966
50											3	4	3	8	10	11	10	11	11	10	125	206	4.024
60										1	4	4	9	11	10	11	10	11	11	10	160	252	4.103
70									1	3	4	8	10	11	10	11	10	11	10	25	180	294	4.097
80									2	4	4	11	11	10	11	10	11	10	11	55	180	330	4.110
90									4	3	7	11	10	11	11	10	11	10	11	84	180	363	4.105
100								1	4	3	9	11	10	11	11	10	11	10	38	85	179	393	4.107
110								2	3	4	10	11	10	11	11	10	11	10	65	84	179	421	4.086
120								2	4	4	11	10	11	10	11	10	11	15	85	84	179	447	4.084
130								3	3	5	11	10	11	10	11	10	11	40	84	84	180	473	4.037
140								3	3	6	10	11	10	11	11	10	11	63	84	84	179	496	4.038
150								3	3	6	11	10	11	11	10	11	12	84	84	84	180	520	3.986
160								3	4	6	10	11	10	11	10	11	34	85	84	84	179	542	3.970
170								3	4	6	10	11	11	10	11	10	56	84	84	85	179	564	3.933
180								3	4	6	11	10	11	10	11	10	77	85	84	84	179	585	3.905
190								3	4	6	11	10	11	10	11	24	84	84	84	84	180	606	3.860
200								3	4	6	11	10	11	10	11	44	84	84	84	84	180	626	3.832
210								3	4	6	11	10	11	11	10	64	84	84	84	84	180	646	3.790
220								3	4	6	11	10	11	11	10	83	84	84	84	84	180	665	3.759
230								3	4	6	11	10	11	11	27	84	85	84	84	84	179	683	3.748
240								3	4	6	11	11	10	11	46	84	84	84	84	85	179	702	3.708

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
72	**msw**																						
5																					0	0	0.877
10																				4	7	11	1.211
20															3	4	3	4	4	3	24	45	3.162
30												2	4	4	3	4	3	10	11	11	55	107	3.911
40										1	3	4	3	4	6	11	10	11	10	11	99	173	3.972
50										3	4	3	6	10	11	10	11	11	10	11	139	229	4.055
60									1	4	3	9	10	11	10	11	11	10	11	10	177	278	4.142
70									4	3	7	11	10	11	10	11	11	10	11	43	179	321	4.149
80								2	4	4	10	11	10	11	11	10	11	10	11	76	179	360	4.127
90								3	4	7	10	11	10	11	11	10	11	10	33	84	179	394	4.135
100							1	4	3	9	11	10	11	10	11	10	11	11	61	84	179	426	4.103
110							2	3	4	10	11	10	11	10	11	10	11	14	85	84	179	455	4.083
120							2	4	4	10	11	11	10	11	10	11	10	41	84	84	180	483	4.038
130							2	4	5	10	11	11	10	11	10	11	10	66	84	84	179	508	4.033
140							3	3	6	10	11	10	11	11	10	11	16	84	84	84	179	533	4.009
150							3	3	6	11	10	11	10	11	11	10	39	85	84	84	179	557	3.963
160							3	4	6	10	11	10	11	10	11	11	62	84	84	84	180	581	3.918
170							3	4	6	10	11	11	10	11	10	11	84	85	84	84	179	603	3.894
180							3	4	6	11	10	11	10	11	10	33	84	84	85	84	179	625	3.856
190							3	4	6	11	10	11	10	11	11	53	84	85	84	84	179	646	3.831
200							3	4	6	11	10	11	10	11	11	74	84	85	84	84	179	667	3.787
210							3	4	6	11	10	11	11	10	21	85	84	84	84	84	180	688	3.738
220							3	4	6	11	10	11	11	10	41	84	84	85	84	84	179	707	3.729
230							3	4	6	11	10	11	11	10	61	84	84	84	84	84	180	727	3.682
240							3	4	6	11	10	11	11	10	80	84	84	84	84	84	180	746	3.647

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
75	**msw**																						
5																					0	0	1.206
10																			2	3	8	13	1.332
20														2	4	4	3	4	3	6	28	54	3.291
30											2	4	3	4	3	4	7	10	11	10	66	124	3.904
40										4	3	4	3	4	11	10	11	10	11	10	112	193	3.986
50									3	3	4	4	10	11	10	11	11	10	11	10	155	253	4.078
60								1	3	4	7	11	10	11	11	10	11	10	11	25	180	305	4.145
70								3	4	6	11	10	11	10	11	11	10	11	10	63	179	350	4.165
80							2	3	4	10	11	11	10	11	10	11	10	11	23	84	180	391	4.122
90							3	4	6	11	10	11	10	11	11	10	11	10	55	85	179	427	4.104
100						1	4	3	9	10	11	10	11	10	11	11	10	11	84	85	179	460	4.085
110						2	3	4	10	10	11	10	11	11	10	11	10	40	84	84	179	490	4.058
120						2	4	4	10	11	10	11	11	10	11	10	11	66	84	84	179	518	4.037
130						2	4	5	10	11	11	10	11	10	11	10	18	85	84	84	179	545	4.000
140						3	3	6	10	11	10	11	10	11	11	10	43	84	85	84	179	571	3.951
150						3	3	6	11	10	11	10	11	11	10	11	67	84	84	84	180	596	3.910
160						3	4	5	11	11	10	11	10	11	10	18	84	84	84	84	180	620	3.870
170						3	4	6	10	11	10	11	11	10	11	40	84	84	84	84	180	643	3.843
180						3	4	6	11	10	11	10	11	10	11	63	84	84	84	84	180	666	3.799
190						3	4	6	11	10	11	10	11	11	10	85	84	84	84	84	180	688	3.757
200						3	4	6	11	10	11	10	11	11	32	84	84	84	84	84	180	709	3.738
210						3	4	6	11	10	11	11	10	11	53	84	84	84	85	84	179	730	3.706
220						3	4	6	11	10	11	11	10	11	73	85	84	84	84	84	180	751	3.655
230						3	4	6	11	10	11	11	10	20	84	84	84	85	84	84	179	770	3.651
240						3	4	6	11	10	11	11	10	40	84	84	84	84	84	85	179	790	3.614

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
78	**msw**																						
5																					0	0	1.575
10																			3	4	7	14	1.494
20													2	3	4	3	4	3	4	9	32	64	3.392
30										1	4	4	3	4	3	4	10	11	11	10	76	141	3.894
40									3	4	3	4	3	9	10	11	11	10	11	10	125	214	4.004
50								3	3	4	3	9	11	10	11	11	10	11	10	11	170	277	4.129
60							1	3	4	6	10	11	11	10	11	10	11	10	11	44	179	332	4.177
70							3	3	6	11	10	11	10	11	11	10	11	10	11	83	179	380	4.163
80						2	3	4	10	10	11	10	11	11	10	11	10	11	45	84	180	423	4.114
90						3	4	6	10	11	10	11	11	10	11	10	11	10	79	84	179	460	4.103
100					1	3	4	8	11	10	11	11	10	11	10	11	10	36	84	84	180	495	4.051
110					2	3	4	9	11	11	10	11	10	11	10	11	11	64	84	84	180	526	4.017
120					2	4	4	10	11	10	11	10	11	11	10	11	18	84	85	84	179	555	3.999
130					2	4	5	10	11	10	11	11	10	11	10	11	45	84	84	84	180	583	3.948
140					3	3	5	11	11	10	11	10	11	10	11	11	70	84	84	85	179	609	3.920
150					3	3	6	11	10	11	10	11	10	11	11	22	84	84	84	84	180	635	3.865
160					3	4	5	11	11	10	11	10	11	10	11	46	84	85	84	84	179	659	3.849
170					3	4	6	10	11	10	11	11	10	11	10	70	84	85	84	84	179	683	3.807
180					3	4	6	10	11	11	10	11	10	11	19	85	84	84	84	84	179	706	3.772
190					3	4	6	11	10	11	10	11	10	11	42	84	84	84	85	84	179	729	3.734
200					3	4	6	11	10	11	10	11	11	10	64	84	84	85	84	84	179	751	3.697
210					3	4	6	11	10	11	11	10	11	12	84	84	84	84	84	85	179	773	3.657
220					3	4	6	11	10	11	11	10	11	33	84	84	84	84	84	85	179	794	3.630
230					3	4	6	11	10	11	11	10	11	53	85	84	84	84	84	84	180	815	3.587
240					3	4	6	11	10	11	11	10	11	73	85	84	84	84	84	84	180	835	3.561

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
81	**msw**																						
10																		2	3	4	7	16	1.635
20												1	3	4	3	4	3	4	4	11	36	73	3.527
30									1	4	3	4	3	4	3	8	10	11	10	11	86	158	3.922
40								3	4	3	4	3	6	11	10	11	10	11	10	11	138	235	4.045
50							3	3	4	3	7	11	10	11	11	10	11	10	11	18	180	303	4.118
60						1	3	4	4	11	11	10	11	10	11	10	11	11	10	63	179	360	4.188
70						3	3	5	11	10	11	10	11	11	10	11	10	11	30	84	179	410	4.185
80					1	4	3	10	11	10	11	10	11	10	11	11	10	11	67	84	180	455	4.114
90					3	3	6	11	10	11	10	11	11	10	11	10	11	28	84	84	180	494	4.082
100				1	3	4	8	10	11	11	10	11	10	11	10	11	11	60	84	84	180	530	4.024
110				1	4	4	9	11	10	11	11	10	11	10	11	10	17	84	84	85	179	562	3.999
120				2	4	3	11	10	11	11	10	11	10	11	10	11	45	84	84	85	179	592	3.955
130				2	4	5	10	11	10	11	10	11	11	10	11	10	73	84	84	84	180	621	3.910
140				3	3	5	11	11	10	11	10	11	10	11	11	25	84	84	84	85	179	648	3.872
150				3	3	6	11	10	11	10	11	10	11	11	10	51	84	84	84	85	179	674	3.840
160				3	3	6	11	11	10	11	10	11	10	11	11	75	85	84	84	84	179	699	3.802
170				3	4	6	10	11	10	11	11	10	11	10	27	84	84	84	85	84	179	724	3.758
180				3	4	6	10	11	11	10	11	10	11	10	51	84	84	84	84	85	179	748	3.719
190				3	4	6	11	10	11	10	11	10	11	11	73	84	85	84	84	84	179	771	3.684
200				3	4	6	11	10	11	10	11	11	10	23	84	84	84	84	84	84	180	794	3.647
210				3	4	6	11	10	11	11	10	11	10	45	84	84	85	84	84	84	179	816	3.622
220				3	4	6	11	10	11	11	10	11	10	67	84	84	84	84	84	85	179	838	3.581
230				3	4	6	11	10	11	11	10	11	14	84	84	84	84	84	85	84	179	859	3.559
240				3	4	6	11	10	11	11	10	11	35	84	84	84	84	84	84	85	179	880	3.524

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
84	**msw**																						
10																		3	4	3	7	17	1.814
20												3	3	4	3	4	4	3	7	11	41	83	3.639
30									4	3	4	3	4	3	4	11	11	10	11	10	97	175	3.931
40							3	3	4	3	4	3	11	10	11	11	10	11	10	11	152	257	4.070
50						2	4	4	3	5	11	10	11	11	10	11	10	11	10	36	179	328	4.163
60					1	3	4	3	11	10	11	10	11	10	11	11	10	11	10	83	179	389	4.186
70					2	4	4	11	10	11	10	11	10	11	11	10	11	10	52	84	179	441	4.175
80				1	4	3	9	11	10	11	11	10	11	10	11	10	11	17	84	84	180	488	4.102
90				3	3	6	10	11	10	11	11	10	11	10	11	10	11	53	84	84	180	529	4.043
100			1	3	4	7	11	11	10	11	10	11	10	11	11	10	12	85	84	84	179	565	4.016
110			1	4	3	10	11	10	11	10	11	10	11	11	10	11	43	84	84	84	180	599	3.953
120			2	3	4	11	10	11	10	11	11	10	11	10	11	10	73	84	84	84	180	630	3.908
130			2	4	4	11	11	10	11	10	11	10	11	11	10	27	84	85	84	84	179	659	3.874
140			3	3	5	11	10	11	11	10	11	10	11	10	11	54	84	85	84	84	179	687	3.835
150			3	3	6	10	11	11	10	11	10	11	10	11	11	80	84	84	85	84	179	714	3.785
160			3	3	6	11	10	11	11	10	11	10	11	10	33	84	84	84	84	84	180	740	3.746
170			3	4	6	10	11	10	11	11	10	11	10	11	58	84	84	84	84	84	180	766	3.698
180			3	4	6	10	11	11	10	11	10	11	10	11	82	84	84	84	84	85	179	790	3.666
190			3	4	6	11	10	11	10	11	10	11	11	32	84	84	84	84	84	84	180	814	3.633
200			3	4	6	11	10	11	10	11	11	10	11	55	84	84	84	85	84	84	179	837	3.605
210			3	4	6	11	10	11	11	10	11	10	11	78	84	84	84	84	84	85	179	860	3.572
220			3	4	6	11	10	11	11	10	11	10	27	84	84	84	85	84	84	84	179	882	3.547
230			3	4	6	11	10	11	11	10	11	10	49	84	84	84	84	84	85	84	179	904	3.512
240			3	4	6	11	10	11	11	10	11	10	70	84	84	84	84	85	84	84	179	925	3.494

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
87	**msw**																						
10																	2	3	4	3	7	19	1.985
20											2	3	4	4	3	4	3	4	9	11	46	93	3.769
30								3	4	3	4	3	4	3	8	11	10	11	10	11	108	193	3.942
40						3	3	4	3	4	3	8	11	10	11	10	11	10	11	11	167	280	4.087
50					2	4	3	4	3	11	10	11	10	11	11	10	11	10	11	53	179	354	4.175
60				1	3	4	3	9	11	10	11	10	11	10	11	11	10	11	29	84	179	418	4.196
70				2	3	4	11	10	11	10	11	10	11	11	10	11	10	11	74	84	179	473	4.154
80			1	3	4	9	10	11	10	11	10	11	11	10	11	10	11	41	84	84	180	522	4.078
90			3	3	5	11	10	11	10	11	11	10	11	10	11	10	11	78	84	84	180	564	4.017
100			4	3	8	10	11	10	11	11	10	11	10	11	10	11	38	85	84	84	179	601	3.980
110		1	4	3	10	10	11	10	11	11	10	11	10	11	10	11	70	84	85	84	179	636	3.930
120		2	3	4	11	10	11	10	11	10	11	11	10	11	10	27	84	85	84	84	179	668	3.880
130		2	4	4	11	10	11	11	10	11	10	11	10	11	11	55	84	85	84	84	179	698	3.841
140		3	3	5	11	10	11	10	11	11	10	11	10	11	10	84	84	85	84	84	179	727	3.785
150		3	3	6	10	11	11	10	11	10	11	10	11	11	36	85	84	84	84	84	180	755	3.740
160		3	3	6	11	10	11	11	10	11	10	11	10	11	63	84	85	84	84	84	179	781	3.708
170		3	4	6	10	11	10	11	10	11	11	10	11	15	84	84	84	85	84	84	179	807	3.671
180		3	4	6	10	11	11	10	11	10	11	10	11	40	84	85	84	84	84	84	180	833	3.617
190		3	4	6	11	10	11	10	11	10	11	11	10	65	84	84	84	84	84	85	179	857	3.590
200		3	4	6	11	10	11	10	11	11	10	11	14	85	84	84	84	84	84	84	180	881	3.559
210		3	4	6	11	10	11	10	11	11	10	11	38	84	84	84	84	85	84	84	179	904	3.533
220		3	4	6	11	10	11	11	10	11	10	11	61	84	84	84	84	84	85	84	179	927	3.504
230		3	4	6	11	10	11	11	10	11	10	11	83	84	84	84	85	84	84	84	179	949	3.485
240		3	4	6	11	10	11	11	10	11	10	32	84	84	84	84	85	84	84	84	179	971	3.454

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
90	**msw**																						
10																	3	4	3	4	7	21	2.161
20										1	4	3	4	3	4	3	4	5	11	11	51	104	3.882
30							3	3	4	3	4	3	4	4	11	10	11	11	10	11	119	211	3.971
40					2	4	3	4	3	4	5	11	10	11	11	10	11	10	11	14	179	303	4.114
50				2	4	3	4	3	9	10	11	10	11	11	10	11	10	11	10	72	179	381	4.181
60			1	3	4	3	8	10	11	10	11	10	11	11	10	11	10	11	50	84	179	448	4.188
70			2	3	4	10	10	11	10	11	10	11	11	10	11	10	11	23	84	84	179	505	4.159
80		1	3	4	8	10	11	11	10	11	10	11	10	11	11	10	11	65	84	84	180	556	4.057
90		2	4	5	10	11	10	11	10	11	11	10	11	10	11	10	30	85	84	84	179	599	4.005
100		4	3	7	11	11	10	11	10	11	10	11	11	10	11	10	65	85	84	84	179	638	3.949
110	1	4	3	9	11	11	10	11	10	11	10	11	11	10	11	24	84	84	85	84	179	674	3.885
120	2	3	4	10	11	10	11	11	10	11	10	11	10	11	11	55	84	84	84	84	180	707	3.829
130	2	4	4	11	10	11	10	11	11	10	11	10	11	10	12	84	84	84	85	84	179	738	3.782
140	3	3	5	11	10	11	10	11	11	10	11	10	11	10	40	85	84	84	84	84	180	768	3.735
150	3	3	6	10	11	10	11	11	10	11	10	11	10	11	68	84	84	84	84	84	180	796	3.689
160	3	3	6	11	10	11	11	10	11	10	11	10	11	21	84	84	84	84	84	85	179	823	3.660
170	3	4	6	10	11	10	11	10	11	11	10	11	10	48	84	84	84	84	84	84	180	850	3.613
180	3	4	6	10	11	11	10	11	10	11	10	11	11	72	84	84	85	84	84	84	179	875	3.592
190	3	4	6	11	10	11	10	11	10	11	11	10	24	84	84	85	84	84	84	84	179	900	3.561
200	3	4	6	11	10	11	10	11	11	10	11	10	49	84	84	84	84	84	85	84	179	925	3.518
210	3	4	6	11	10	11	10	11	11	10	11	10	72	84	85	84	84	84	84	84	180	949	3.486
220	3	4	6	11	10	11	11	10	11	10	11	22	84	84	84	84	85	84	84	84	179	972	3.470
230	3	4	6	11	10	11	11	10	11	10	11	45	84	84	84	84	84	84	85	84	179	995	3.440
240	3	4	6	11	10	11	11	10	11	10	11	67	84	84	84	84	85	84	84	84	179	1017	3.425

APPENDIX F XVAL-HE-9_050 1.3 ATM PO_2 $HE\text{-}O_2$ DECOMPRESSION TABLES (FSW)

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																				TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
80	**fsw**																						
86																					0	0	3.354
90																					3	3	2.992
100																					10	10	3.155
110																					17	17	3.289
120																					23	23	3.433
130																					29	29	3.551
140																					34	34	3.687
150																					39	39	3.803
160																					43	43	3.941
170																					47	47	4.061
180																					51	51	4.165
190																					55	55	4.253
200																					58	58	4.374
210																					62	62	4.441
220																					65	65	4.544
230																					69	69	4.594
240																					73	73	4.634

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
90	**fsw**																						
46																					0	0	2.539
50																					1	1	2.436
60																					2	2	2.778
70																					4	4	2.924
80																					14	14	3.070
90																					23	23	3.247
100																					31	31	3.423
110																					38	38	3.602
120																					45	45	3.750
130																					51	51	3.909
140																					57	57	4.042
150																					63	63	4.151
160																					69	69	4.245
170																					74	74	4.370
180																					79	79	4.483
190																					83	83	4.629
200																					89	89	4.673
210																					95	95	4.704
220																					101	101	4.723
230																					107	107	4.732
240																					113	113	4.730

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
100	**fsw**																						
32																					0	0	2.355
40																					2	2	2.412
50																					4	4	2.651
60																					8	8	2.886
70																					20	20	3.112
80																					31	31	3.315
90																					40	40	3.544
100																					49	49	3.726
110																					58	58	3.863
120																					66	66	4.007
130																					74	74	4.127
140																					81	81	4.274
150																					88	88	4.405
160																					95	95	4.520
170																					101	101	4.663
180																					108	108	4.746
190																					116	116	4.769
200																					124	124	4.777
210																					132	132	4.773
220																				1	138	139	4.805
230																				1	145	146	4.819
240																				1	152	153	4.822

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
110	**fsw**																						
25																					0	0	2.305
30																					2	2	2.262
40																					4	4	2.824
50																					7	7	2.978
60																				1	21	22	3.118
70																				2	33	35	3.360
80																				2	45	47	3.573
90																				3	55	58	3.769
100																				3	66	69	3.905
110																				3	75	78	4.090
120																				3	85	88	4.210
130																				3	94	97	4.353
140																				4	101	105	4.523
150																				4	109	113	4.668
160																				4	118	122	4.750
170																				4	128	132	4.774
180																				4	137	141	4.825
190																				4	147	151	4.816
200																				4	156	160	4.835
210																				4	164	168	4.884
220																				4	173	177	4.876
230																			1	3	181	185	4.908
240																			1	6	186	193	4.915

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	P_{DCS}
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	
120	**fsw**																						
21																					0	0	2.392
30																					4	4	2.493
40																					7	7	2.937
50																				2	18	20	3.052
60																				3	33	36	3.325
70																			1	4	45	50	3.585
80																			2	4	58	64	3.764
90																			3	3	70	76	3.954
100																			3	3	82	88	4.102
110																			3	4	92	99	4.276
120																			3	4	103	110	4.416
130																			3	4	113	120	4.577
140																			4	3	122	129	4.770
150																			4	3	134	141	4.801
160																			4	3	145	152	4.855
170																			4	3	157	164	4.847
180																			4	3	168	175	4.864
190																			4	3	178	185	4.908
200																			4	5	186	195	4.935
210																			4	15	186	205	4.940
220																			4	25	185	214	4.969
230																		1	3	34	186	224	4.957
240																		1	3	43	186	233	4.956

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop 220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	P_{DCS}
130	**fsw**																						
18																					0	0	2.429
20																					1	1	2.569
30																					6	6	2.774
40																				2	10	12	2.962
50																			1	4	27	32	3.271
60																			3	4	43	50	3.511
70																		1	4	3	58	66	3.742
80																		2	3	4	72	81	3.916
90																		2	4	5	84	95	4.104
100																		3	3	6	96	108	4.286
110																		3	4	6	107	120	4.481
120																		3	4	7	118	132	4.637
130																		3	4	7	129	143	4.815
140																		4	3	7	143	157	4.849
150																		4	3	8	156	171	4.851
160																		4	3	8	169	184	4.875
170																		4	3	8	181	196	4.922
180																		4	3	15	186	208	4.946
190																		4	3	27	186	220	4.945
200																		4	3	38	186	231	4.966
210																		4	3	49	186	242	4.969
220																		4	3	60	185	252	4.995
230																	1	3	4	69	186	263	4.986
240																	1	3	4	79	186	273	4.986

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
140	**fsw**																						
15																					0	0	2.127
20																					4	4	2.039
30																				1	8	9	2.843
40																			2	3	18	23	3.139
50																		1	3	4	37	45	3.434
60																		3	3	6	52	64	3.707
70																	1	3	4	8	66	82	3.932
80																	2	3	4	10	79	98	4.142
90																	2	4	4	11	92	113	4.347
100																	3	3	6	10	106	128	4.518
110																	3	4	6	10	118	141	4.729
120																	3	4	6	11	131	155	4.850
130																	3	4	7	11	146	171	4.868
140																	3	4	7	11	161	186	4.897
150																	4	3	8	10	176	201	4.918
160																	4	3	8	14	186	215	4.951
170																	4	3	8	28	186	229	4.952
180																	4	3	8	41	186	242	4.972
190																	4	3	8	54	186	255	4.972
200																	4	3	8	66	186	267	4.993
210																	4	3	8	78	186	279	5.000
220																	4	3	8	90	186	291	4.992
230																	4	3	20	89	186	302	5.001
240																1	3	4	30	89	186	313	5.009

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
150	**fsw**																						
13																					0	0	1.977
20																					6	6	2.084
30																			1	4	9	14	2.658
40																		1	3	4	26	34	3.320
50																		3	4	7	43	57	3.657
60																	2	4	4	11	58	79	3.904
70																	4	3	8	10	73	98	4.168
80																1	4	4	9	11	87	116	4.383
90																2	4	4	10	11	102	133	4.575
100																3	3	5	11	11	115	148	4.777
110																3	4	5	11	11	132	166	4.833
120																3	4	6	11	11	148	183	4.884
130																3	4	7	11	10	165	200	4.912
140																3	4	7	11	11	180	216	4.938
150																4	3	8	10	21	186	232	4.967
160																4	3	8	11	35	186	247	4.987
170																4	3	8	11	50	186	262	4.981
180																4	3	8	11	64	186	276	4.996
190																4	3	8	11	78	186	290	5.001
200																4	3	8	13	90	185	303	5.024
210																4	3	8	26	90	185	316	5.024
220																4	3	8	39	89	186	329	5.007
230																4	3	8	51	89	186	341	5.009
240															1	3	4	8	62	90	186	354	4.977

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
160	**fsw**																						
11																					0	0	1.616
20																				2	7	9	1.945
30																			4	3	14	21	2.882
40																		3	4	6	32	45	3.494
50																	3	3	6	11	48	71	3.846
60																2	3	4	10	11	65	95	4.103
70																3	4	7	10	11	81	116	4.378
80															1	4	3	10	10	11	96	135	4.633
90															2	3	4	11	11	10	112	153	4.844
100															2	4	5	11	10	11	131	174	4.867
110															3	3	6	11	11	10	149	193	4.919
120															3	4	6	11	11	10	167	212	4.931
130															3	4	7	10	11	11	183	229	4.986
140															3	4	7	11	11	25	186	247	4.975
150															4	3	8	10	11	42	186	264	4.986
160															4	3	8	10	11	58	186	280	4.993
170															4	3	8	11	10	74	185	295	5.031
180															4	3	8	11	10	89	186	311	5.012
190															4	3	8	11	24	90	186	326	5.003
200															4	3	8	11	39	89	186	340	5.010
210															4	3	8	11	53	89	186	354	5.004
220															4	3	8	11	66	90	186	368	4.984
230															4	3	8	11	79	90	186	381	4.983
240														1	3	4	8	13	90	89	186	394	4.982

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
170	**fsw**																						
10																					0	0	1.636
20																			1	3	8	12	1.946
30																		3	4	3	17	27	3.141
40																	3	4	3	11	37	58	3.632
50																2	4	4	11	11	54	86	4.032
60															1	4	3	10	11	11	71	111	4.353
70															3	4	6	10	11	11	89	134	4.630
80														1	3	4	9	11	10	11	107	156	4.843
90														2	3	4	10	11	11	11	127	179	4.869
100														2	4	5	10	11	11	11	147	201	4.908
110														3	3	6	11	10	11	11	167	222	4.944
120														3	4	6	11	10	11	11	185	241	5.012
130														3	4	7	10	11	11	28	186	260	5.016
140														3	4	7	11	11	10	47	186	279	4.996
150														4	3	7	11	11	11	63	186	296	5.026
160														4	3	8	10	11	11	80	186	313	5.046
170														4	3	8	11	10	19	89	186	330	5.038
180														4	3	8	11	10	35	89	186	346	5.033
190														4	3	8	11	11	49	90	186	362	5.015
200														4	3	8	11	11	65	89	186	377	5.019
210														4	3	8	11	11	80	89	186	392	5.004
220														4	3	8	11	16	89	90	185	406	5.005
230														4	3	8	11	30	89	90	185	420	4.993
240													1	3	4	8	10	44	89	90	186	435	4.953

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																				TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
180	**fsw**																						
9																					0	0	1.559
10																					2	2	1.286
20																			3	4	7	14	2.139
30																	3	3	4	4	24	38	3.232
40																3	3	4	8	11	42	71	3.816
50															2	3	4	10	11	11	61	102	4.219
60														1	3	4	9	10	11	11	80	129	4.567
70														3	3	6	10	11	11	11	99	154	4.823
80													1	3	4	8	11	11	10	11	122	181	4.916
90													2	3	4	10	11	10	11	11	144	206	4.950
100													2	4	4	11	11	11	10	11	165	229	4.988
110													3	3	6	10	11	11	11	10	186	251	5.028
120													3	4	6	11	10	11	11	30	186	272	5.017
130													3	4	7	10	11	11	10	50	186	292	5.027
140													3	4	7	11	10	11	11	68	186	311	5.028
150													3	4	7	11	11	11	10	87	185	329	5.060
160													4	3	8	10	11	11	25	90	186	348	5.030
170													4	3	8	11	10	11	43	89	186	365	5.042
180													4	3	8	11	10	11	60	89	186	382	5.033
190													4	3	8	11	11	10	76	90	186	399	5.007
200													4	3	8	11	11	13	89	90	186	415	4.995
210													4	3	8	11	11	28	90	89	186	430	5.003
220													4	3	8	11	11	44	89	90	186	446	4.963
230													4	3	8	11	11	59	89	90	186	461	4.939
240													4	3	8	11	11	73	90	89	186	475	4.932

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
190	**fsw**																						
8																					0	0	1.392
10																					3	3	1.397
20																		2	4	3	8	17	2.363
30																2	4	3	4	7	29	49	3.365
40															2	4	4	5	11	11	48	85	3.978
50														1	4	3	9	11	11	10	69	118	4.439
60														4	3	8	11	10	11	11	89	147	4.801
70													2	4	5	10	11	11	11	10	114	178	4.922
80													4	3	8	11	11	10	11	11	138	207	4.953
90												1	4	4	9	11	11	11	10	11	162	234	5.006
100												2	4	4	11	10	11	11	11	10	184	258	5.058
110												3	3	5	11	11	11	10	11	30	186	281	5.047
120												3	4	6	10	11	11	11	10	52	185	303	5.055
130												3	4	6	11	11	11	10	11	71	186	324	5.053
140												3	4	7	11	10	11	11	12	89	186	344	5.062
150												3	4	7	11	11	11	10	31	90	186	364	5.035
160												4	3	8	10	11	11	11	49	90	186	383	5.029
170												4	3	8	11	10	11	11	68	89	186	401	5.035
180												4	3	8	11	10	11	11	86	89	186	419	5.012
190												4	3	8	11	11	10	24	90	89	186	436	5.007
200												4	3	8	11	11	10	41	90	89	186	453	4.986
210												4	3	8	11	11	10	58	89	90	186	470	4.946
220												4	3	8	11	11	10	74	89	90	185	485	4.953
230												4	3	8	11	11	10	89	90	89	186	501	4.920
240												4	3	8	11	11	25	90	89	90	185	516	4.905

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
200	**fsw**																						
7																					0	0	1.133
10																					5	5	1.172
20																	1	4	3	4	11	23	2.532
30															2	3	4	4	3	11	33	60	3.522
40														2	4	3	4	10	11	11	55	100	4.127
50													1	3	4	7	11	11	10	11	77	135	4.634
60													3	4	7	10	11	11	10	11	102	169	4.922
70												2	4	4	10	11	11	11	10	11	129	203	4.990
80												3	4	7	11	11	11	10	11	11	155	234	5.009
90											1	4	3	10	11	10	11	11	11	10	180	262	5.081
100											2	4	4	10	11	11	11	10	11	29	185	288	5.064
110											3	3	5	11	11	10	11	11	11	51	185	312	5.066
120											3	3	6	11	11	11	10	11	11	72	186	335	5.073
130											3	4	6	11	11	10	11	11	15	89	186	357	5.077
140											3	4	7	11	10	11	11	11	35	90	185	378	5.072
150											3	4	7	11	11	10	11	11	55	90	185	398	5.069
160											4	3	8	10	11	11	11	10	75	90	186	419	5.025
170											4	3	8	10	11	11	11	15	89	90	185	437	5.039
180											4	3	8	11	10	11	11	33	90	89	186	456	5.013
190											4	3	8	11	10	11	11	51	90	90	185	474	4.992
200											4	3	8	11	11	10	11	69	90	89	186	492	4.958
210											4	3	8	11	11	10	11	86	90	89	186	509	4.937
220											4	3	8	11	11	10	25	89	90	89	186	526	4.907
230											4	3	8	11	11	10	41	89	90	89	186	542	4.890
240											4	3	8	11	11	10	57	89	90	89	186	558	4.855

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
210	**fsw**																						
7																					0	0	1.563
10																					6	6	1.305
20																	4	3	4	3	14	28	2.734
30														1	4	4	3	4	7	11	38	72	3.685
40													2	4	3	4	8	10	11	11	62	115	4.310
50												1	3	4	5	11	11	10	11	11	86	153	4.810
60												3	3	6	11	11	10	11	11	11	116	193	4.919
70											2	3	4	10	11	11	11	10	11	11	145	229	5.028
80											3	4	7	10	11	11	11	10	11	11	173	262	5.057
90										1	4	3	9	11	11	11	10	11	11	24	186	292	5.053
100										2	3	4	11	11	10	11	11	11	10	49	186	319	5.074
110										2	4	5	11	10	11	11	11	10	11	72	186	344	5.098
120										3	3	6	11	11	10	11	11	11	16	89	186	368	5.082
130										3	4	6	11	11	10	11	11	11	38	89	186	391	5.074
140										3	4	7	10	11	11	11	10	11	60	89	186	413	5.061
150										3	4	7	11	11	10	11	11	11	80	89	186	434	5.050
160										4	3	8	10	11	11	10	11	22	90	89	186	455	5.022
170										4	3	8	10	11	11	11	10	42	89	90	186	475	4.996
180										4	3	8	11	10	11	11	11	60	90	89	186	494	4.986
190										4	3	8	11	10	11	11	11	79	89	90	186	513	4.948
200										4	3	8	11	11	10	11	19	90	89	90	185	531	4.939
210										4	3	8	11	11	10	11	37	90	89	90	185	549	4.905
220										4	3	8	11	11	10	11	54	90	89	90	186	567	4.856
230										4	3	8	11	11	10	11	71	90	89	90	186	584	4.827
240										4	3	8	11	11	10	11	88	89	90	90	185	600	4.816

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
220	**fsw**																						
6																					0	0	1.168
10																				1	7	8	1.258
20																3	3	4	3	4	16	33	2.964
30													1	3	4	4	3	4	11	10	44	84	3.837
40												2	3	4	4	5	11	10	11	11	70	131	4.469
50											1	3	4	3	11	11	10	11	11	11	98	174	4.892
60											2	4	5	10	11	11	11	10	11	11	131	217	5.012
70										1	4	4	9	11	11	11	10	11	11	11	162	256	5.053
80										3	4	6	11	10	11	11	11	10	11	17	186	291	5.076
90									1	4	3	9	11	10	11	11	11	10	11	45	185	322	5.102
100									2	3	4	11	10	11	11	11	10	11	11	70	185	350	5.107
110									2	4	5	10	11	11	11	10	11	11	16	89	186	377	5.084
120									3	3	6	11	11	10	11	11	10	11	40	89	186	402	5.083
130									3	4	6	11	10	11	11	11	10	11	63	89	186	426	5.061
140									3	4	7	10	11	11	11	10	11	11	84	90	186	449	5.034
150									3	4	7	11	11	10	11	11	11	27	89	90	185	470	5.044
160									4	3	7	11	11	11	10	11	11	48	90	89	186	492	4.999
170									4	3	8	10	11	11	11	10	11	69	89	90	186	513	4.961
180									4	3	8	11	10	11	11	11	10	89	89	90	186	533	4.938
190									4	3	8	11	10	11	11	11	29	89	90	89	186	552	4.925
200									4	3	8	11	11	10	11	11	48	90	89	90	185	571	4.895
210									4	3	8	11	11	10	11	11	67	89	90	89	186	590	4.848
220									4	3	8	11	11	10	11	11	85	89	90	89	186	608	4.822
230									4	3	8	11	11	10	11	24	89	90	89	90	186	626	4.782
240									4	3	8	11	11	10	11	41	89	90	89	90	186	643	4.755

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
230	**fsw**																						
6																					0	0	1.568
10																				3	7	10	1.198
20															2	3	4	3	4	4	20	40	3.139
30													4	3	4	3	4	8	10	11	50	97	3.983
40											1	4	4	3	4	10	10	11	11	11	77	146	4.688
50											4	3	4	8	11	11	11	10	11	11	112	196	4.943
60										2	3	4	11	11	10	11	11	11	10	11	147	242	5.093
70									1	4	3	9	11	11	11	10	11	11	11	10	181	284	5.110
80									3	3	6	11	11	10	11	11	11	10	11	37	185	320	5.118
90								1	3	4	8	11	11	11	10	11	11	11	10	65	186	353	5.116
100								2	3	4	10	11	11	10	11	11	11	10	14	89	186	383	5.101
110								2	4	4	11	11	11	10	11	11	11	10	39	90	185	410	5.106
120								3	3	6	11	10	11	11	11	10	11	11	63	90	186	437	5.060
130								3	4	6	11	10	11	11	11	10	11	11	87	90	185	461	5.068
140								3	4	7	10	11	11	11	10	11	11	31	90	89	186	485	5.032
150								3	4	7	11	11	10	11	11	10	11	54	89	90	186	508	4.995
160								4	3	7	11	11	11	10	11	11	11	75	89	90	186	530	4.962
170								4	3	8	10	11	11	11	10	11	18	89	90	89	186	551	4.949
180								4	3	8	11	10	11	11	11	10	39	89	90	89	186	572	4.911
190								4	3	8	11	10	11	11	11	10	59	89	90	89	186	592	4.874
200								4	3	8	11	11	10	11	11	10	79	89	90	89	186	612	4.839
210								4	3	8	11	11	10	11	11	18	90	89	90	89	186	631	4.813
220								4	3	8	11	11	10	11	11	37	89	90	89	90	186	650	4.770
230								4	3	8	11	11	10	11	11	55	90	89	90	89	186	668	4.746
240								4	3	8	11	11	10	11	11	73	90	89	90	89	186	686	4.711

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
240	**fsw**																						
5																					0	0	1.038
10																			1	3	8	12	1.280
20														1	3	4	4	3	4	4	26	49	3.263
30												3	4	3	4	3	5	10	11	11	56	110	4.136
40										1	4	3	4	4	7	11	10	11	11	11	87	164	4.825
50										4	3	4	6	11	11	11	10	11	11	11	126	219	4.994
60									2	3	4	10	10	11	11	10	11	11	11	10	165	269	5.101
70								1	3	4	8	11	11	11	10	11	11	10	11	25	186	313	5.107
80								3	3	5	11	11	11	10	11	11	11	10	11	57	186	351	5.100
90							1	3	4	8	11	10	11	11	11	10	11	11	11	86	186	385	5.117
100							2	3	4	10	11	10	11	11	11	10	11	11	36	89	186	416	5.100
110							2	4	4	11	11	10	11	11	11	10	11	11	62	90	186	445	5.072
120							3	3	6	10	11	11	11	10	11	11	11	10	88	90	186	472	5.053
130							3	4	6	10	11	11	11	10	11	11	11	33	90	89	186	497	5.043
140							3	4	6	11	11	11	10	11	11	11	10	58	89	90	186	522	4.993
150							3	4	7	11	10	11	11	11	10	11	11	80	90	89	186	545	4.974
160							3	4	7	11	11	11	10	11	11	11	23	90	89	90	186	568	4.938
170							4	3	8	10	11	11	11	10	11	11	46	89	90	89	186	590	4.909
180							4	3	8	11	10	11	11	11	10	11	67	90	89	90	186	612	4.855
190							4	3	8	11	10	11	11	11	10	11	88	90	89	90	185	632	4.841
200							4	3	8	11	11	10	11	11	10	30	89	90	90	89	186	653	4.791
210							4	3	8	11	11	10	11	11	11	49	89	90	89	90	186	673	4.752
220							4	3	8	11	11	10	11	11	11	68	90	89	90	89	186	692	4.728
230							4	3	8	11	11	10	11	11	11	87	90	89	90	89	186	711	4.691
240							4	3	8	11	11	10	11	11	27	90	89	90	89	90	185	729	4.670

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
250	**fsw**																						
5																					0	0	1.399
10																			2	4	7	13	1.432
20														3	4	3	4	3	4	7	30	58	3.380
30											3	3	4	3	4	4	8	10	11	11	63	124	4.289
40									1	4	3	4	3	5	11	11	10	11	11	11	99	184	4.877
50									3	4	4	4	11	11	11	10	11	11	11	10	143	244	5.010
60								1	4	4	8	11	11	10	11	11	10	11	11	11	182	296	5.110
70								4	3	8	11	10	11	11	11	10	11	11	11	43	186	341	5.137
80							2	4	5	10	11	11	11	10	11	11	11	10	11	78	186	382	5.122
90							4	3	8	11	11	10	11	11	10	11	11	11	30	89	186	417	5.120
100						1	4	4	9	11	11	11	10	11	11	11	10	11	59	90	186	450	5.090
110						2	4	4	11	10	11	11	11	10	11	11	11	10	87	90	186	480	5.059
120						3	3	5	11	11	11	10	11	11	11	10	11	34	90	90	185	507	5.053
130						3	4	6	10	11	11	11	10	11	11	11	10	60	90	89	186	534	5.013
140						3	4	6	11	11	11	10	11	11	11	10	11	84	90	89	186	559	4.975
150						3	4	7	11	10	11	11	11	10	11	11	29	90	89	90	185	583	4.949
160						3	4	7	11	11	11	10	11	11	10	11	52	90	89	90	186	607	4.890
170						4	3	8	10	11	11	11	10	11	11	11	74	90	89	90	186	630	4.851
180						4	3	8	11	10	11	11	10	11	11	18	89	90	90	89	186	652	4.816
190						4	3	8	11	10	11	11	11	10	11	39	90	89	90	89	186	673	4.788
200						4	3	8	11	11	10	11	11	10	11	61	89	90	89	90	185	694	4.754
210						4	3	8	11	11	10	11	11	11	10	81	89	90	89	90	186	715	4.706
220						4	3	8	11	11	10	11	11	11	21	90	89	90	89	90	186	735	4.668
230						4	3	8	11	11	10	11	11	11	41	90	89	90	89	90	185	754	4.649
240						4	3	8	11	11	10	11	11	11	60	90	89	90	89	90	185	773	4.619

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
260	**fsw**																						
10																		1	3	4	7	15	1.575
20													2	4	3	4	3	4	4	9	35	68	3.486
30										2	4	3	4	3	4	5	10	11	11	11	69	137	4.475
40								1	3	4	3	4	4	9	11	11	10	11	11	10	113	205	4.922
50								3	4	4	3	10	11	11	10	11	11	11	10	11	159	269	5.031
60							1	4	4	7	10	11	11	11	10	11	11	11	10	26	186	324	5.126
70							3	4	7	11	10	11	11	11	10	11	11	11	10	64	186	371	5.158
80						2	4	4	11	10	11	11	11	10	11	11	11	10	21	90	185	413	5.147
90						4	3	8	10	11	11	10	11	11	11	10	11	11	53	90	185	450	5.125
100					1	4	3	10	11	11	10	11	11	11	10	11	11	10	84	89	186	484	5.104
110					2	4	4	10	11	11	11	10	11	11	11	10	11	33	90	89	186	515	5.062
120					3	3	5	11	11	11	10	11	11	10	11	11	11	60	90	89	186	544	5.017
130					3	3	6	11	11	11	10	11	11	11	10	11	11	86	90	89	186	571	4.981
140					3	4	6	11	11	10	11	11	11	10	11	11	33	89	90	89	186	597	4.946
150					3	4	7	11	10	11	11	11	10	11	11	11	57	89	90	89	186	622	4.904
160					3	4	7	11	11	10	11	11	11	10	11	11	81	89	90	89	186	646	4.860
170					4	3	8	10	11	11	11	10	11	11	10	26	89	90	89	90	186	670	4.815
180					4	3	8	11	10	11	11	10	11	11	11	48	89	90	89	90	185	692	4.789
190					4	3	8	11	10	11	11	11	10	11	11	70	89	90	89	90	186	715	4.730
200					4	3	8	11	10	11	11	11	10	11	13	89	90	89	90	89	186	736	4.702
210					4	3	8	11	11	10	11	11	11	10	34	89	90	89	90	90	185	757	4.673
220					4	3	8	11	11	10	11	11	11	10	55	89	90	89	90	89	186	778	4.628
230					4	3	8	11	11	10	11	11	11	10	74	90	89	90	90	89	186	798	4.596
240					4	3	8	11	11	10	11	11	11	15	89	90	89	90	89	90	186	818	4.561

BT (min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																						
270	**fsw**																						
10																		2	4	4	7	17	1.729
20												1	4	3	4	4	3	4	5	10	40	78	3.619
30									2	3	4	3	4	4	3	8	11	11	11	10	78	152	4.606
40								4	3	4	3	4	7	11	10	11	11	11	10	11	126	226	4.966
50							3	4	3	4	8	11	11	10	11	11	11	10	11	11	175	294	5.076
60						1	4	4	5	11	11	10	11	11	11	10	11	11	11	44	186	352	5.138
70						3	4	6	11	10	11	11	11	10	11	11	11	10	11	85	186	402	5.157
80					2	3	4	11	11	10	11	11	11	10	11	11	11	10	43	90	185	445	5.151
90					3	4	7	11	10	11	11	11	10	11	11	11	10	11	77	89	186	484	5.113
100				1	4	3	10	10	11	11	11	10	11	11	11	10	11	29	90	89	186	519	5.075
110				2	4	3	11	11	11	10	11	11	11	10	11	11	11	58	90	89	186	551	5.034
120				2	4	5	11	11	10	11	11	11	10	11	11	11	10	87	89	90	186	581	4.986
130				3	3	6	11	11	11	10	11	11	11	10	11	11	35	89	90	89	186	609	4.948
140				3	4	6	11	11	10	11	11	11	10	11	11	11	60	90	89	90	186	636	4.888
150				3	4	7	11	10	11	11	10	11	11	11	10	11	86	90	89	90	185	661	4.863
160				3	4	7	11	11	10	11	11	11	10	11	11	31	90	89	90	89	186	686	4.812
170				4	3	8	10	11	11	10	11	11	11	10	11	55	90	89	90	89	186	710	4.774
180				4	3	8	10	11	11	11	10	11	11	11	10	79	89	90	89	90	186	734	4.715
190				4	3	8	11	10	11	11	11	10	11	11	22	89	90	89	90	90	185	756	4.697
200				4	3	8	11	10	11	11	11	10	11	11	44	90	89	90	89	90	186	779	4.639
210				4	3	8	11	11	10	11	11	11	10	11	66	89	90	89	90	89	186	800	4.622
220				4	3	8	11	11	10	11	11	11	10	11	87	89	90	90	89	90	185	821	4.590
230				4	3	8	11	11	10	11	11	11	10	29	90	89	90	89	90	89	186	842	4.552
240				4	3	8	11	11	10	11	11	11	10	49	90	89	90	89	90	89	186	862	4.525

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20		
280	**fsw**																						
10																	1	3	4	3	8	19	1.884
20												3	4	4	3	4	3	4	8	11	44	88	3.749
30								1	4	3	4	3	4	4	4	11	11	10	11	11	85	166	4.779
40							3	4	4	3	4	4	11	11	10	11	11	10	11	11	141	249	4.965
50						3	4	3	4	6	11	11	10	11	11	10	11	11	11	17	186	320	5.107
60					1	4	3	5	10	11	11	11	10	11	11	11	10	11	11	63	186	380	5.177
70					3	3	6	11	10	11	11	10	11	11	11	10	11	11	27	90	186	433	5.148
80				2	3	4	10	11	11	10	11	11	11	10	11	11	11	10	66	90	186	479	5.112
90				3	4	6	11	11	11	10	11	11	11	10	11	11	11	22	89	90	185	518	5.103
100			1	4	3	9	11	11	11	10	11	11	11	10	11	11	10	55	90	89	186	555	5.049
110			2	3	4	11	11	10	11	11	11	10	11	11	11	10	11	85	89	90	186	588	4.989
120			2	4	5	11	10	11	11	11	10	11	11	11	10	11	35	90	89	90	186	619	4.936
130			3	3	6	11	11	10	11	11	11	10	11	11	11	10	63	89	90	89	186	647	4.906
140			3	4	6	11	11	10	11	11	11	10	11	11	10	11	90	89	90	89	186	675	4.853
150			3	4	7	10	11	11	11	10	11	11	11	10	11	36	90	89	90	89	186	701	4.807
160			3	4	7	11	11	10	11	11	11	10	11	11	11	61	89	90	89	90	186	727	4.750
170			4	3	7	11	11	11	10	11	11	11	10	11	11	85	90	89	90	89	186	751	4.722
180			4	3	8	10	11	11	11	10	11	11	11	10	31	89	90	89	90	89	186	775	4.680
190			4	3	8	11	10	11	11	11	10	11	11	11	53	90	89	90	89	90	186	799	4.632
200			4	3	8	11	10	11	11	11	10	11	11	11	76	89	90	89	90	89	186	821	4.607
210			4	3	8	11	11	10	11	11	11	10	11	20	89	90	89	90	89	90	186	844	4.563
220			4	3	8	11	11	10	11	11	11	10	11	41	90	89	90	89	90	90	185	865	4.543
230			4	3	8	11	11	10	11	11	11	10	11	63	89	90	89	90	89	90	185	886	4.513
240			4	3	8	11	11	10	11	11	11	10	11	83	90	89	90	89	90	90	185	907	4.486

BT (min)	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop 220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	TST (min)	P_{DCS}
290	**fsw**																						
10																	2	4	3	4	7	20	2.091
20											2	4	4	3	4	3	4	4	10	11	49	98	3.882
30							1	3	4	3	4	4	3	4	8	11	11	10	11	11	96	184	4.833
40						3	4	3	4	4	3	9	11	10	11	11	11	10	11	11	155	271	5.036
50					3	4	3	4	4	11	10	11	11	11	10	11	11	11	10	35	186	346	5.143
60				1	4	3	4	10	11	10	11	11	11	10	11	11	11	10	11	84	186	410	5.178
70				2	4	5	10	11	11	11	10	11	11	11	10	11	11	11	49	89	186	464	5.169
80			1	4	4	9	11	11	11	10	11	11	11	10	11	11	11	10	90	89	186	512	5.121
90			3	4	6	11	10	11	11	11	10	11	11	11	10	11	11	47	90	89	186	554	5.062
100		1	4	3	9	11	10	11	11	11	10	11	11	11	10	11	11	80	90	89	186	591	5.020
110		2	3	4	11	10	11	11	11	10	11	11	11	10	11	11	33	90	89	90	185	625	4.973
120		2	4	5	10	11	11	11	10	11	11	11	10	11	11	11	62	90	89	90	185	656	4.924
130		3	3	6	11	11	10	11	11	10	11	11	11	10	11	13	89	90	89	90	185	686	4.868
140		3	4	6	11	10	11	11	11	10	11	11	11	10	11	39	90	89	90	90	185	714	4.821
150		3	4	7	10	11	11	11	10	11	11	11	10	11	11	66	89	90	89	90	186	742	4.753
160		3	4	7	11	11	10	11	11	11	10	11	11	11	12	90	89	90	89	90	185	767	4.731
170		4	3	7	11	11	11	10	11	11	11	10	11	11	37	90	89	90	90	89	186	793	4.669
180		4	3	8	10	11	11	11	10	11	11	11	10	11	62	89	90	89	90	90	185	817	4.643
190		4	3	8	11	10	11	11	11	10	11	11	11	10	86	89	90	90	89	90	185	841	4.604
200		4	3	8	11	10	11	11	11	10	11	11	11	30	89	90	89	90	89	90	186	865	4.552
210		4	3	8	11	11	10	11	11	10	11	11	11	52	90	89	90	90	89	90	185	887	4.535
220		4	3	8	11	11	10	11	11	11	10	11	11	75	89	90	89	90	89	90	186	910	4.491
230		4	3	8	11	11	10	11	11	11	10	11	18	89	90	90	89	90	89	90	185	931	4.479
240		4	3	8	11	11	10	11	11	11	10	11	39	90	89	90	89	90	89	90	185	952	4.452

BT	DECOMPRESSION STOPS (fsw) Stop times (min) include travel time, except first stop																					TST	
(min)	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	(min)	P_{DCS}
300	**fsw**																						
10																1	3	4	3	4	7	22	2.287
20										2	3	4	3	4	3	4	4	6	11	11	54	109	4.018
30							3	4	3	4	4	3	4	5	11	11	10	11	11	11	107	202	4.875
40					3	3	4	4	3	4	6	11	11	10	11	11	11	10	11	11	171	295	5.041
50				3	3	4	4	3	10	10	11	11	11	10	11	11	11	10	11	53	186	373	5.159
60			1	4	3	4	8	11	11	11	10	11	11	11	10	11	11	11	25	90	186	440	5.176
70			2	4	4	10	11	11	11	10	11	11	11	10	11	11	11	10	72	90	186	497	5.143
80		1	4	3	10	10	11	11	11	10	11	11	11	10	11	11	11	34	90	89	186	546	5.110
90		3	3	6	11	11	11	10	11	11	11	10	11	11	11	10	11	73	89	90	185	589	5.047
100	1	3	4	9	10	11	11	11	10	11	11	10	11	11	11	10	29	89	90	89	186	628	4.984
110	2	3	4	10	11	11	11	10	11	11	11	10	11	11	10	11	61	89	90	89	186	663	4.919
120	2	4	5	10	11	11	10	11	11	11	10	11	11	11	10	12	90	90	89	90	185	695	4.871
130	3	3	6	11	10	11	11	11	10	11	11	11	10	11	11	41	89	90	89	90	186	726	4.807
140	3	4	6	11	10	11	11	11	10	11	11	11	10	11	11	69	90	89	90	89	186	755	4.757
150	3	4	7	10	11	11	11	10	11	11	11	10	11	11	17	90	89	90	89	90	185	782	4.723
160	3	4	7	11	11	10	11	11	11	10	11	11	10	11	44	89	90	89	90	89	186	809	4.669
170	4	3	7	11	11	11	10	11	11	11	10	11	11	11	68	90	89	90	89	90	186	835	4.622
180	4	3	8	10	11	11	11	10	11	11	11	10	11	15	90	89	90	89	90	89	186	860	4.586
190	4	3	8	11	10	11	11	11	10	11	11	10	11	40	89	90	89	90	89	90	186	885	4.539
200	4	3	8	11	10	11	11	11	10	11	11	11	10	63	90	89	90	89	90	89	186	908	4.517
210	4	3	8	11	11	10	11	11	10	11	11	11	10	87	89	90	89	90	89	90	186	932	4.480
220	4	3	8	11	11	10	11	11	11	10	11	11	30	89	90	89	90	89	90	89	186	954	4.464
230	4	3	8	11	11	10	11	11	11	10	11	11	52	90	89	90	89	90	89	90	186	977	4.421
240	4	3	8	11	11	10	11	11	11	10	11	11	74	89	90	89	90	89	90	90	185	998	4.414

APPENDIX G XVAL-HE-9_050 1.3 ATM PO_2 $HE\text{-}O_2$ DECOMPRESSION TABLES (MSW)

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
24	**msw**																						
90																					0	0	3.248
100																					8	8	3.040
110																					14	14	3.200
120																					20	20	3.332
130																					26	26	3.440
140																					31	31	3.566
150																					35	35	3.713
160																					39	39	3.842
170																					44	44	3.912
180																					47	47	4.052
190																					51	51	4.133
200																					54	54	4.245
210																					58	58	4.303
220																					61	61	4.398
230																					64	64	4.484
240																					68	68	4.517

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
27	**msw**																						
50																					0	0	2.576
60																					1	1	2.853
70																					2	2	3.131
80																					11	11	3.005
90																					20	20	3.167
100																					28	28	3.329
110																					35	35	3.497
120																					42	42	3.632
130																					48	48	3.781
140																					54	54	3.903
150																					59	59	4.045
160																					65	65	4.128
170																					70	70	4.242
180																					75	75	4.344
190																					79	79	4.479
200																					83	83	4.603
210																					90	90	4.580
220																					95	95	4.635
230																					101	101	4.635
240																					107	107	4.624

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
30	**msw**																						
34																					0	0	2.349
40																					2	2	2.155
50																					3	3	2.698
60																					5	5	2.935
70																					17	17	3.046
80																					28	28	3.231
90																					37	37	3.444
100																					46	46	3.612
110																					55	55	3.737
120																					63	63	3.869
130																					70	70	4.018
140																					77	77	4.151
150																					84	84	4.269
160																					90	90	4.416
170																					96	96	4.547
180																					102	102	4.663
190																					110	110	4.674
200																					118	118	4.672
210																					125	125	4.701
220																					132	132	4.717
230																					139	139	4.721
240																					146	146	4.715

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																				TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
33	**msw**																						
26																					0	0	2.236
30																					1	1	2.452
40																					4	4	2.534
50																					6	6	2.950
60																					19	19	3.048
70																				1	31	32	3.277
80																				2	42	44	3.471
90																				2	53	55	3.647
100																				3	62	65	3.819
110																				3	72	75	3.946
120																				3	81	84	4.093
130																				3	90	93	4.221
140																				3	98	101	4.373
150																				3	105	108	4.549
160																				3	113	116	4.664
170																				3	122	125	4.718
180																				3	132	135	4.712
190																				3	141	144	4.735
200																				3	150	153	4.742
210																				3	158	161	4.780
220																				3	167	170	4.761
230																				3	174	177	4.815
240																				3	182	185	4.815

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
36	**msw**																						
22																					0	0	2.387
30																					3	3	2.642
40																					6	6	2.961
50																				2	15	17	2.984
60																				3	30	33	3.236
70																			1	3	43	47	3.479
80																			2	3	55	60	3.681
90																			2	4	67	73	3.820
100																			2	4	78	84	3.993
110																			3	3	89	95	4.151
120																			3	3	99	105	4.321
130																			3	4	108	115	4.470
140																			3	4	117	124	4.636
150																			3	4	128	135	4.698
160																			3	4	139	146	4.739
170																			3	4	150	157	4.761
180																			3	4	161	168	4.766
190																			3	4	171	178	4.798
200																			3	4	181	188	4.815
210																			3	12	182	197	4.852
220																			3	21	183	207	4.831
230																			3	30	183	216	4.835
240																			3	39	182	224	4.866

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
39	**msw**																						
18																					0	0	2.154
20																					1	1	2.276
30																					6	6	2.462
40																				2	8	10	2.960
50																			1	4	25	30	3.147
60																			3	3	41	47	3.404
70																		1	3	4	55	63	3.625
80																		1	4	3	69	77	3.821
90																		2	3	4	82	91	3.973
100																		2	4	4	93	103	4.190
110																		3	3	5	105	116	4.325
120																		3	3	6	115	127	4.511
130																		3	3	6	126	138	4.675
140																		3	4	6	138	151	4.737
150																		3	4	6	151	164	4.765
160																		3	4	6	164	177	4.774
170																		3	4	6	176	189	4.807
180																		3	4	11	183	201	4.821
190																		3	4	23	182	212	4.849
200																		3	4	34	182	223	4.859
210																		3	4	44	183	234	4.853
220																		3	4	55	182	244	4.869
230																		3	4	65	182	254	4.871
240																		3	4	74	183	264	4.864

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																				TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
42	**msw**																						
16																					0	0	2.281
20																					3	3	2.210
30																				1	7	8	2.866
40																			1	4	16	21	3.035
50																			4	3	34	41	3.364
60																		2	4	4	51	61	3.577
70																		3	4	7	63	77	3.856
80																	1	4	3	9	77	94	4.013
90																	2	3	4	10	90	109	4.193
100																	2	4	4	11	102	123	4.382
110																	3	3	5	11	115	137	4.532
120																	3	3	6	10	127	149	4.741
130																	3	3	6	11	141	164	4.782
140																	3	4	6	10	157	180	4.770
150																	3	4	6	10	171	194	4.806
160																	3	4	6	12	182	207	4.867
170																	3	4	6	25	183	221	4.855
180																	3	4	6	39	182	234	4.861
190																	3	4	6	51	182	246	4.889
200																	3	4	6	63	183	259	4.859
210																	3	4	6	75	182	270	4.894
220																	3	4	6	86	183	282	4.876
230																	3	4	15	88	183	293	4.877
240																	3	4	26	88	182	303	4.897

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
45	**msw**																						
13																					0	0	1.738
20																					6	6	1.816
30																				4	8	12	2.636
40																			3	4	24	31	3.236
50																		3	4	5	42	54	3.523
60																	2	3	4	10	56	75	3.789
70																	3	4	6	10	71	94	4.014
80																1	3	4	8	11	85	112	4.206
90																2	3	4	10	10	99	128	4.424
100																2	4	4	10	11	112	143	4.620
110																2	4	5	10	11	127	159	4.737
120																3	3	5	11	11	143	176	4.776
130																3	3	6	11	10	160	193	4.786
140																3	4	5	11	11	174	208	4.855
150																3	4	6	10	18	183	224	4.864
160																3	4	6	11	33	182	239	4.872
170																3	4	6	11	47	182	253	4.896
180																3	4	6	11	61	182	267	4.899
190																3	4	6	11	75	182	281	4.891
200																3	4	6	11	88	182	294	4.905
210																3	4	6	24	88	182	307	4.894
220																3	4	6	36	88	182	319	4.902
230																3	4	6	48	88	182	331	4.894
240																3	4	6	59	88	183	343	4.875

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
48	**msw**																						
12																					0	0	1.918
20																				1	7	8	1.995
30																			3	4	12	19	2.782
40																		3	3	5	31	42	3.378
50																	2	4	5	10	47	68	3.696
60																1	4	3	10	10	62	90	4.006
70																3	3	6	10	11	78	111	4.216
80															1	3	4	8	10	11	93	130	4.461
90															1	4	4	9	11	10	108	147	4.693
100															2	4	3	11	10	11	125	166	4.772
110															2	4	4	11	11	10	144	186	4.767
120															3	3	5	11	10	11	161	204	4.813
130															3	3	6	11	10	11	177	221	4.876
140															3	3	6	11	11	22	182	238	4.890
150															3	4	6	10	11	39	182	255	4.889
160															3	4	6	10	11	54	183	271	4.886
170															3	4	6	11	10	70	182	286	4.912
180															3	4	6	11	10	85	182	301	4.919
190															3	4	6	11	22	88	182	316	4.902
200															3	4	6	11	36	88	182	330	4.900
210															3	4	6	11	49	88	183	344	4.885
220															3	4	6	11	63	88	182	357	4.888
230															3	4	6	11	76	88	182	370	4.876
240															3	4	6	11	88	88	183	383	4.853

DECOMPRESSION STOPS (msw)
Stop times (min) include travel time, except first stop

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
51	**msw**																						
10																					0	0	1.423
20																				3	7	10	2.098
30																		3	3	4	16	26	2.992
40																	2	4	3	10	35	54	3.550
50																2	3	4	10	11	52	82	3.898
60															1	3	4	8	11	10	70	107	4.174
70															2	4	5	10	11	11	86	129	4.435
80															4	3	8	10	11	10	103	149	4.701
90														1	4	3	10	10	11	10	123	172	4.745
100														2	3	4	10	11	11	10	142	193	4.791
110														2	4	4	11	10	11	10	161	213	4.849
120														3	3	5	11	10	11	10	180	233	4.864
130														3	3	6	10	11	11	25	182	251	4.910
140														3	3	6	11	10	11	43	182	269	4.913
150														3	4	6	10	11	10	60	183	287	4.904
160														3	4	6	10	11	11	76	183	304	4.904
170														3	4	6	11	10	16	88	182	320	4.924
180														3	4	6	11	10	31	89	182	336	4.910
190														3	4	6	11	10	47	88	182	351	4.918
200														3	4	6	11	10	62	88	183	367	4.877
210														3	4	6	11	10	77	88	182	381	4.889
220														3	4	6	11	13	88	88	182	395	4.884
230														3	4	6	11	27	88	88	182	409	4.863
240														3	4	6	11	40	88	88	183	423	4.83

DECOMPRESSION STOPS (msw)
Stop times (min) include travel time, except first stop

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
54	**msw**																						
9																					0	0	1.353
10																					1	1	1.498
20																			2	4	7	13	2.085
30																	2	4	3	4	21	34	3.178
40																2	4	3	7	11	40	67	3.695
50															1	4	3	9	11	10	59	97	4.089
60															4	3	8	10	11	10	78	124	4.379
70														2	4	4	11	10	11	10	95	147	4.709
80														3	4	7	11	10	11	10	117	173	4.771
90													1	4	3	9	11	10	11	10	139	198	4.800
100													2	3	4	10	11	10	11	10	159	220	4.863
110													2	4	4	11	10	11	10	11	179	242	4.884
120													3	3	5	11	10	11	10	27	183	263	4.892
130													3	3	6	10	11	10	11	46	182	282	4.919
140													3	3	6	11	10	11	10	64	183	301	4.918
150													3	4	6	10	11	10	11	82	183	320	4.915
160													3	4	6	10	11	11	22	88	182	337	4.936
170													3	4	6	11	10	11	39	88	182	354	4.937
180													3	4	6	11	10	11	56	88	182	371	4.918
190													3	4	6	11	10	11	72	88	183	388	4.881
200													3	4	6	11	10	11	88	88	182	403	4.895
210													3	4	6	11	10	26	88	88	183	419	4.861
220													3	4	6	11	10	41	88	89	182	434	4.846
230													3	4	6	11	10	56	88	88	183	449	4.817
240													3	4	6	11	11	69	88	88	183	463	4.805

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
57	**msw**																						
8																					0	0	1.199
10																					3	3	1.192
20																		2	3	4	7	16	2.255
30																2	3	4	3	6	27	45	3.282
40															2	3	4	5	10	11	46	81	3.840
50														1	3	4	7	11	10	11	66	113	4.262
60														3	4	6	11	10	11	10	86	141	4.628
70													2	3	4	11	10	11	10	11	108	170	4.767
80													3	4	6	11	10	11	11	10	132	198	4.833
90												1	4	3	9	10	11	10	11	10	156	225	4.851
100												2	3	4	10	10	11	10	11	11	177	249	4.872
110												2	4	4	10	11	10	11	11	26	182	271	4.930
120												2	4	5	10	11	11	10	11	47	182	293	4.924
130												3	3	6	10	11	10	11	10	67	183	314	4.922
140												3	3	6	11	10	11	10	11	86	183	334	4.923
150												3	4	5	11	11	10	11	27	88	183	353	4.930
160												3	4	6	10	11	10	11	46	88	182	371	4.940
170												3	4	6	11	10	11	10	64	88	183	390	4.903
180												3	4	6	11	10	11	10	82	88	182	407	4.905
190												3	4	6	11	10	11	21	88	88	182	424	4.888
200												3	4	6	11	10	11	37	88	89	182	441	4.860
210												3	4	6	11	10	11	54	88	88	182	457	4.845
220												3	4	6	11	10	11	69	88	88	183	473	4.816
230												3	4	6	11	10	11	85	88	88	182	488	4.803
240												3	4	6	11	11	22	88	88	88	182	503	4.784

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
60	**msw**																						
8																					0	0	1.663
10																					4	4	1.293
20																	1	3	4	3	10	21	2.441
30															1	4	3	4	3	10	31	56	3.422
40														2	3	4	3	10	10	11	52	95	4.014
50														3	4	6	11	10	11	10	74	129	4.472
60													3	3	6	10	11	10	11	11	96	161	4.767
70												2	3	4	10	10	11	10	11	10	124	195	4.812
80												3	4	6	10	11	10	11	10	11	149	225	4.856
90											1	3	4	8	11	10	11	10	11	11	172	252	4.910
100											2	3	4	9	11	11	10	11	10	25	182	278	4.928
110											2	4	3	11	11	10	11	10	11	46	183	302	4.930
120											2	4	5	10	11	10	11	10	11	68	182	324	4.960
130											3	3	5	11	11	10	11	10	12	88	182	346	4.958
140											3	3	6	11	10	11	10	11	31	88	183	367	4.943
150											3	4	5	11	11	10	11	10	51	89	182	387	4.937
160											3	4	6	10	11	10	11	11	70	88	183	407	4.904
170											3	4	6	10	11	11	10	12	88	88	182	425	4.915
180											3	4	6	11	10	11	10	30	88	88	183	444	4.879
190											3	4	6	11	10	11	10	48	88	88	183	462	4.852
200											3	4	6	11	10	11	11	64	88	89	182	479	4.837
210											3	4	6	11	10	11	11	81	88	88	183	496	4.810
220											3	4	6	11	10	11	21	88	88	88	183	513	4.773
230											3	4	6	11	10	11	37	88	88	88	183	529	4.750
240											3	4	6	11	11	10	52	89	88	88	182	544	4.739

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
63	**msw**																						
7																					0	0	1.358
10																					6	6	1.109
20																	3	4	3	4	12	26	2.639
30														1	3	4	3	4	6	11	36	68	3.557
40													1	4	3	4	7	10	11	11	58	109	4.208
50													3	4	4	11	10	11	10	11	82	146	4.664
60												2	4	4	11	11	10	11	10	11	110	184	4.818
70											1	4	3	10	10	11	10	11	10	11	139	220	4.867
80											3	3	6	10	11	11	10	11	10	11	166	252	4.895
90										1	3	4	8	10	11	10	11	10	11	20	182	281	4.947
100										1	4	3	10	11	10	11	10	11	10	44	183	308	4.941
110										2	4	3	11	10	11	10	11	11	10	67	183	333	4.945
120										2	4	4	11	11	10	11	10	11	12	88	183	357	4.946
130										3	3	5	11	10	11	11	10	11	34	88	182	379	4.956
140										3	3	6	10	11	11	10	11	10	55	88	183	401	4.933
150										3	3	6	11	11	10	11	10	11	75	88	183	422	4.919
160										3	4	6	10	11	10	11	11	17	88	89	182	442	4.909
170										3	4	6	10	11	11	10	11	37	88	88	183	462	4.879
180										3	4	6	11	10	11	10	11	56	88	89	182	481	4.858
190										3	4	6	11	10	11	10	11	75	88	88	182	499	4.843
200										3	4	6	11	10	11	11	15	88	88	88	183	518	4.793
210										3	4	6	11	10	11	11	33	88	88	88	182	535	4.784
220										3	4	6	11	10	11	11	50	88	88	88	182	552	4.757
230										3	4	6	11	10	11	11	66	89	88	88	182	569	4.719
240										3	4	6	11	11	10	11	83	88	88	88	183	586	4.678

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
66	**msw**																						
6																					0	0	0.994
10																					7	7	1.246
20																2	4	3	4	3	16	32	2.814
30														3	4	4	3	4	10	10	41	79	3.737
40												1	4	3	4	4	11	10	11	10	67	125	4.325
50												3	4	3	10	10	11	10	11	10	93	165	4.812
60											2	3	4	11	10	11	10	11	10	11	125	208	4.867
70										1	3	4	9	10	11	10	11	10	11	11	155	246	4.914
80										3	3	5	11	10	11	10	11	11	10	13	182	280	4.940
90										4	3	8	10	11	10	11	11	10	11	39	183	311	4.933
100									1	4	3	10	10	11	10	11	11	10	11	64	183	339	4.951
110									2	3	4	11	10	11	10	11	10	11	11	89	182	365	4.961
120									2	4	4	11	10	11	11	10	11	10	35	88	182	389	4.974
130									3	3	5	11	10	11	10	11	11	10	57	89	182	413	4.943
140									3	3	6	10	11	11	10	11	10	11	79	88	183	436	4.915
150									3	3	6	11	10	11	11	10	11	22	88	89	182	457	4.912
160									3	4	6	10	11	10	11	10	11	44	88	88	183	479	4.865
170									3	4	6	10	11	11	10	11	10	64	88	88	183	499	4.851
180									3	4	6	11	10	11	10	11	10	84	88	88	183	519	4.816
190									3	4	6	11	10	11	10	11	25	88	89	88	182	538	4.794
200									3	4	6	11	10	11	10	11	44	88	88	88	183	557	4.756
210									3	4	6	11	10	11	11	10	62	88	88	88	183	575	4.731
220									3	4	6	11	10	11	11	10	80	88	88	89	182	593	4.697
230									3	4	6	11	10	11	11	20	88	88	88	88	182	610	4.679
240									3	4	6	11	11	10	11	37	88	88	88	88	182	627	4.648

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
69	**msw**																						
6																					0	0	1.363
10																				2	7	9	1.213
20															1	4	3	4	3	4	18	37	3.046
30													3	4	3	4	3	7	10	11	47	92	3.862
40											1	3	4	4	3	9	10	11	11	10	74	140	4.531
50											3	4	3	8	10	11	10	11	11	10	106	187	4.848
60										1	4	4	9	11	10	11	10	11	11	10	141	233	4.900
70									1	3	4	8	10	11	10	11	10	11	10	11	173	273	4.958
80									2	4	4	11	11	10	11	10	11	10	11	31	183	309	4.958
90									4	3	7	11	10	11	11	10	11	10	11	59	183	341	4.962
100								1	4	3	9	11	10	11	11	10	11	10	11	86	182	370	4.989
110								2	3	4	10	11	10	11	11	10	11	10	34	88	182	397	4.986
120								2	4	4	11	10	11	10	11	10	11	11	58	88	182	423	4.959
130								3	3	5	11	10	11	10	11	10	11	11	81	88	183	448	4.924
140								3	3	6	10	11	10	11	11	10	11	26	88	88	183	471	4.912
150								3	3	6	11	10	11	11	10	11	10	49	88	88	182	493	4.902
160								3	4	6	10	11	10	11	10	11	11	70	88	88	182	515	4.866
170								3	4	6	10	11	11	10	11	10	14	88	88	88	182	536	4.840
180								3	4	6	11	10	11	10	11	10	34	88	89	88	182	557	4.793
190								3	4	6	11	10	11	10	11	11	53	88	88	88	183	577	4.754
200								3	4	6	11	10	11	10	11	11	73	88	88	88	182	596	4.730
210								3	4	6	11	10	11	11	10	15	88	88	88	88	182	615	4.698
220								3	4	6	11	10	11	11	10	33	88	88	88	88	183	634	4.651
230								3	4	6	11	10	11	11	10	51	88	88	88	89	182	652	4.620
240								3	4	6	11	11	10	11	10	69	88	88	88	88	183	670	4.585

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
72	**msw**																						
5																					0	0	0.877
10																				4	7	11	1.211
20															3	4	3	4	4	3	24	45	3.162
30												2	4	4	3	4	3	10	11	11	52	104	4.038
40										1	3	4	3	4	6	11	10	11	10	11	82	156	4.716
50										3	4	3	6	10	11	10	11	11	10	11	120	210	4.870
60									1	4	3	9	10	11	10	11	11	10	11	10	157	258	4.964
70									4	3	7	11	10	11	10	11	11	10	11	19	183	301	4.967
80								2	4	4	10	11	10	11	11	10	11	10	11	51	182	338	4.997
90								3	4	7	10	11	10	11	11	10	11	10	11	80	183	372	4.982
100							1	4	3	9	11	10	11	10	11	10	11	11	30	88	183	403	4.970
110							2	3	4	10	11	10	11	10	11	10	11	11	56	89	182	431	4.959
120							2	4	4	10	11	11	10	11	10	11	10	11	82	88	183	458	4.925
130							2	4	5	10	11	11	10	11	10	11	10	29	88	88	182	482	4.938
140							3	3	6	10	11	10	11	11	10	11	10	52	89	88	182	507	4.890
150							3	3	6	11	10	11	10	11	11	10	11	74	88	88	183	530	4.856
160							3	4	6	10	11	10	11	10	11	11	19	88	88	88	183	553	4.820
170							3	4	6	10	11	11	10	11	10	11	41	88	88	88	183	575	4.778
180							3	4	6	11	10	11	10	11	10	11	62	88	88	88	183	596	4.742
190							3	4	6	11	10	11	10	11	11	10	83	88	88	88	183	617	4.696
200							3	4	6	11	10	11	10	11	11	25	88	88	88	88	183	637	4.662
210							3	4	6	11	10	11	11	10	11	44	88	88	89	88	182	656	4.641
220							3	4	6	11	10	11	11	10	11	64	88	88	88	88	182	675	4.611
230							3	4	6	11	10	11	11	10	11	82	88	88	88	89	182	694	4.572
240							3	4	6	11	10	11	11	10	23	88	88	89	88	88	182	712	4.542

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
75	**msw**																						
5																					0	0	1.206
10																			2	3	8	13	1.332
20														2	4	4	3	4	3	6	28	54	3.291
30											2	4	3	4	3	4	7	10	11	10	60	118	4.160
40										4	3	4	3	4	11	10	11	10	11	10	94	175	4.772
50									3	3	4	4	10	11	10	11	11	10	11	10	135	233	4.924
60								1	3	4	7	11	10	11	11	10	11	10	11	10	174	284	5.006
70								3	4	6	11	10	11	10	11	11	10	11	10	39	182	329	5.007
80							2	3	4	10	11	11	10	11	10	11	10	11	11	71	182	368	5.008
90							3	4	6	11	10	11	10	11	11	10	11	10	25	88	182	403	5.011
100						1	4	3	9	10	11	10	11	10	11	11	10	11	53	88	183	436	4.966
110						2	3	4	10	10	11	10	11	11	10	11	10	11	81	88	182	465	4.947
120						2	4	4	10	11	10	11	11	10	11	10	11	29	88	88	182	492	4.942
130						2	4	5	10	11	11	10	11	10	11	10	11	54	88	88	183	519	4.881
140						3	3	6	10	11	10	11	10	11	11	10	11	78	88	88	182	543	4.871
150						3	3	6	11	10	11	10	11	11	10	11	24	88	88	88	183	568	4.808
160						3	4	5	11	11	10	11	10	11	10	11	47	88	88	88	183	591	4.773
170						3	4	6	10	11	10	11	11	10	11	10	69	89	88	88	182	613	4.745
180						3	4	6	11	10	11	10	11	10	11	13	89	88	88	88	182	635	4.709
190						3	4	6	11	10	11	10	11	11	10	34	89	88	88	88	182	656	4.673
200						3	4	6	11	10	11	10	11	11	10	55	88	89	88	88	182	677	4.628
210						3	4	6	11	10	11	11	10	11	10	76	88	88	88	88	183	698	4.577
220						3	4	6	11	10	11	11	10	11	17	88	88	88	88	89	182	717	4.559
230						3	4	6	11	10	11	11	10	11	37	88	88	88	88	88	183	737	4.509
240						3	4	6	11	10	11	11	10	11	55	88	89	88	88	88	182	755	4.496

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
78	**msw**																						
5																					0	0	1.575
10																			3	4	7	14	1.494
20													2	3	4	3	4	3	4	9	32	64	3.392
30										1	4	4	3	4	3	4	10	11	11	10	66	131	4.324
40									3	4	3	4	3	9	10	11	11	10	11	10	106	195	4.828
50								3	3	4	3	9	11	10	11	11	10	11	10	11	151	258	4.916
60							1	3	4	6	10	11	11	10	11	10	11	10	11	20	182	311	5.034
70							3	3	6	11	10	11	10	11	11	10	11	10	11	58	182	358	5.023
80						2	3	4	10	10	11	10	11	11	10	11	10	11	15	88	182	399	5.027
90						3	4	6	10	11	10	11	11	10	11	10	11	10	47	88	183	436	4.990
100					1	3	4	8	11	10	11	11	10	11	10	11	10	11	77	88	182	469	4.976
110					2	3	4	9	11	11	10	11	10	11	10	11	11	27	88	88	183	500	4.922
120					2	4	4	10	11	10	11	10	11	11	10	11	10	55	88	88	182	528	4.912
130					2	4	5	10	11	10	11	11	10	11	10	11	10	80	88	89	182	555	4.864
140					3	3	5	11	11	10	11	10	11	10	11	11	27	88	88	88	183	581	4.817
150					3	3	6	11	10	11	10	11	10	11	11	10	51	89	88	88	182	605	4.790
160					3	4	5	11	11	10	11	10	11	10	11	11	75	88	88	88	182	629	4.749
170					3	4	6	10	11	10	11	11	10	11	10	21	88	88	88	88	183	653	4.687
180					3	4	6	10	11	11	10	11	10	11	10	43	88	88	88	88	183	675	4.656
190					3	4	6	11	10	11	10	11	10	11	11	64	88	88	88	89	182	697	4.616
200					3	4	6	11	10	11	10	11	11	10	11	85	88	88	89	88	182	718	4.584
210					3	4	6	11	10	11	11	10	11	10	29	88	88	89	88	88	182	739	4.546
220					3	4	6	11	10	11	11	10	11	10	50	88	88	88	88	88	183	760	4.497
230					3	4	6	11	10	11	11	10	11	10	69	88	88	89	88	88	182	779	4.482
240					3	4	6	11	10	11	11	10	11	11	88	88	88	88	88	88	183	799	4.441

BT	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST	
(min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	(min)	P_{DCS}
81	**msw**																						
10																		2	3	4	7	16	1.635
20												1	3	4	3	4	3	4	4	11	36	73	3.527
30									1	4	3	4	3	4	3	8	10	11	10	11	73	145	4.487
40								3	4	3	4	3	6	11	10	11	10	11	10	11	119	216	4.863
50							3	3	4	3	7	11	10	11	11	10	11	10	11	10	167	282	4.978
60						1	3	4	4	11	11	10	11	10	11	10	11	11	10	38	183	339	5.031
70						3	3	5	11	10	11	10	11	11	10	11	10	11	10	78	183	388	5.034
80					1	4	3	10	11	10	11	10	11	10	11	11	10	11	36	88	183	431	5.009
90					3	3	6	11	10	11	10	11	11	10	11	10	11	10	70	89	182	469	4.978
100				1	3	4	8	10	11	11	10	11	10	11	10	11	11	23	88	88	182	503	4.965
110				1	4	4	9	11	10	11	11	10	11	10	11	10	11	52	89	88	182	535	4.913
120				2	4	3	11	10	11	11	10	11	10	11	10	11	11	79	89	88	182	564	4.872
130				2	4	5	10	11	10	11	10	11	11	10	11	10	29	89	88	88	182	592	4.832
140				3	3	5	11	11	10	11	10	11	10	11	11	10	55	88	88	88	182	618	4.795
150				3	3	6	11	10	11	10	11	10	11	11	10	11	79	88	88	88	183	644	4.736
160				3	3	6	11	11	10	11	10	11	10	11	11	25	89	88	88	88	182	668	4.703
170				3	4	6	10	11	10	11	11	10	11	10	11	49	89	88	88	88	182	692	4.657
180				3	4	6	10	11	11	10	11	10	11	10	11	73	88	88	88	88	182	715	4.616
190				3	4	6	11	10	11	10	11	10	11	11	17	88	88	88	88	88	183	738	4.565
200				3	4	6	11	10	11	10	11	11	10	11	39	88	88	88	88	88	183	760	4.527
210				3	4	6	11	10	11	11	10	11	10	11	60	88	89	88	88	88	182	781	4.502
220				3	4	6	11	10	11	11	10	11	10	11	81	88	88	88	89	88	182	802	4.466
230				3	4	6	11	10	11	11	10	11	10	25	88	88	88	88	88	88	183	823	4.424
240				3	4	6	11	10	11	11	10	11	10	44	88	89	88	88	88	88	182	842	4.412

BT (min)	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																						
84 msw																							
10																		3	4	3	7	17	1.814
20												3	3	4	3	4	4	3	7	11	41	83	3.639
30									4	3	4	3	4	3	4	11	11	10	11	10	81	159	4.629
40							3	3	4	3	4	3	11	10	11	11	10	11	10	11	133	238	4.875
50						2	4	4	3	5	11	10	11	11	10	11	10	11	10	12	182	307	5.028
60					1	3	4	3	11	10	11	10	11	10	11	11	10	11	10	57	183	367	5.048
70					2	4	4	11	10	11	10	11	10	11	11	10	11	10	21	89	182	418	5.048
80				1	4	3	9	11	10	11	11	10	11	10	11	10	11	11	58	89	182	463	5.009
90				3	3	6	10	11	10	11	11	10	11	10	11	10	11	16	88	88	183	503	4.956
100			1	3	4	7	11	11	10	11	10	11	10	11	11	10	11	48	88	88	182	538	4.937
110			1	4	3	10	11	10	11	10	11	10	11	11	10	11	10	78	88	88	183	571	4.873
120			2	3	4	11	10	11	10	11	11	10	11	10	11	10	29	88	88	89	182	601	4.831
130			2	4	4	11	11	10	11	10	11	10	11	11	10	11	56	88	88	88	182	629	4.797
140			3	3	5	11	10	11	11	10	11	10	11	10	11	11	82	88	88	88	183	657	4.730
150			3	3	6	10	11	11	10	11	10	11	10	11	11	30	88	88	88	88	183	683	4.682
160			3	3	6	11	10	11	11	10	11	10	11	10	11	55	88	88	88	88	183	708	4.640
170			3	4	6	10	11	10	11	11	10	11	10	11	10	80	88	88	88	88	183	733	4.591
180			3	4	6	10	11	11	10	11	10	11	10	11	25	88	88	88	89	88	182	756	4.561
190			3	4	6	11	10	11	10	11	10	11	11	10	48	88	89	88	88	88	182	779	4.525
200			3	4	6	11	10	11	10	11	11	10	11	10	71	88	88	88	88	88	183	802	4.477
210			3	4	6	11	10	11	11	10	11	10	11	15	88	88	88	88	88	88	183	824	4.447
220			3	4	6	11	10	11	11	10	11	10	11	36	88	88	89	88	88	88	182	845	4.422
230			3	4	6	11	10	11	11	10	11	10	11	57	88	88	88	88	89	88	182	866	4.390
240			3	4	6	11	10	11	11	10	11	10	11	78	88	88	88	88	88	88	183	887	4.354

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop 66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6	TST (min)	P_{DCS}
87	**msw**																						
10																	2	3	4	3	7	19	1.985
20											2	3	4	4	3	4	3	4	9	11	46	93	3.769
30								3	4	3	4	3	4	3	8	11	10	11	10	11	90	175	4.729
40						3	3	4	3	4	3	8	11	10	11	10	11	10	11	11	147	260	4.92
50					2	4	3	4	3	11	10	11	10	11	11	10	11	10	11	28	183	333	5.026
60				1	3	4	3	9	11	10	11	10	11	10	11	11	10	11	10	77	182	395	5.083
70				2	3	4	11	10	11	10	11	10	11	11	10	11	10	11	42	88	183	449	5.046
80			1	3	4	9	10	11	10	11	10	11	11	10	11	10	11	10	82	89	182	496	4.999
90			3	3	5	11	10	11	10	11	11	10	11	10	11	10	11	40	88	89	182	537	4.942
100			4	3	8	10	11	10	11	11	10	11	10	11	10	11	11	73	88	88	182	573	4.905
110		1	4	3	10	10	11	10	11	11	10	11	10	11	10	11	27	88	88	88	182	607	4.858
120		2	3	4	11	10	11	10	11	10	11	11	10	11	10	11	56	88	88	88	182	638	4.803
130		2	4	4	11	10	11	11	10	11	10	11	10	11	11	10	84	88	88	88	183	668	4.735
140		3	3	5	11	10	11	10	11	11	10	11	10	11	10	34	88	88	88	88	182	695	4.707
150		3	3	6	10	11	11	10	11	10	11	10	11	11	10	59	89	88	88	88	182	722	4.653
160		3	3	6	11	10	11	11	10	11	10	11	10	11	11	84	88	88	88	88	183	748	4.600
170		3	4	6	10	11	10	11	10	11	11	10	11	10	32	88	88	88	89	88	182	773	4.559
180		3	4	6	10	11	11	10	11	10	11	10	11	11	55	89	88	88	88	88	182	797	4.525
190		3	4	6	11	10	11	10	11	10	11	11	10	11	79	88	88	88	88	88	183	821	4.478
200		3	4	6	11	10	11	10	11	11	10	11	10	25	88	88	88	89	88	88	182	844	4.446
210		3	4	6	11	10	11	10	11	11	10	11	10	47	88	89	88	88	88	88	182	866	4.418
220		3	4	6	11	10	11	11	10	11	10	11	10	70	88	88	88	88	88	88	183	889	4.371
230		3	4	6	11	10	11	11	10	11	10	11	13	88	88	88	88	89	88	88	182	910	4.358
240		3	4	6	11	10	11	11	10	11	10	11	34	88	88	88	88	88	88	89	182	931	4.329

BT (min)	DECOMPRESSION STOPS (msw) Stop times (min) include travel time, except first stop																					TST (min)	P_{DCS}
	66	63	60	57	54	51	48	45	42	39	36	33	30	27	24	21	18	15	12	9	6		
90	**msw**																						
10																	3	4	3	4	7	21	2.161
20										1	4	3	4	3	4	3	4	5	11	11	51	104	3.882
30							3	3	4	3	4	3	4	4	11	10	11	11	10	11	101	193	4.755
40					2	4	3	4	3	4	5	11	10	11	11	10	11	10	11	10	163	283	4.933
50				2	4	3	4	3	9	10	11	10	11	11	10	11	10	11	10	47	182	359	5.055
60			1	3	4	3	8	10	11	10	11	10	11	11	10	11	10	11	19	89	182	425	5.063
70			2	3	4	10	10	11	10	11	10	11	11	10	11	10	11	10	65	88	183	481	5.028
80		1	3	4	8	10	11	11	10	11	10	11	10	11	11	10	11	28	88	88	182	529	4.994
90		2	4	5	10	11	10	11	10	11	11	10	11	10	11	10	11	65	88	88	183	572	4.907
100		4	3	7	11	11	10	11	10	11	10	11	11	10	11	10	22	88	88	88	183	610	4.853
110	1	4	3	9	11	11	10	11	10	11	10	11	11	10	11	10	53	89	88	88	182	644	4.810
120	2	3	4	10	11	10	11	11	10	11	10	11	10	11	11	10	83	88	89	88	182	676	4.748
130	2	4	4	11	10	11	10	11	11	10	11	10	11	10	11	34	88	89	88	88	182	706	4.701
140	3	3	5	11	10	11	10	11	11	10	11	10	11	10	11	62	88	88	89	88	182	735	4.645
150	3	3	6	10	11	10	11	11	10	11	10	11	10	11	11	88	88	88	88	89	182	762	4.600
160	3	3	6	11	10	11	11	10	11	10	11	10	11	11	37	88	88	88	88	88	183	789	4.542
170	3	4	6	10	11	10	11	10	11	11	10	11	10	11	62	88	89	88	88	88	182	814	4.515
180	3	4	6	10	11	11	10	11	10	11	10	11	11	10	87	88	88	88	89	88	182	839	4.475
190	3	4	6	11	10	11	10	11	10	11	11	10	11	33	88	88	89	88	88	88	182	863	4.439
200	3	4	6	11	10	11	10	11	11	10	11	10	11	57	88	88	88	88	88	88	183	887	4.395
210	3	4	6	11	10	11	10	11	11	10	11	10	11	80	88	88	88	88	88	88	183	910	4.367
220	3	4	6	11	10	11	11	10	11	10	11	10	25	88	88	89	88	88	88	88	182	932	4.350
230	3	4	6	11	10	11	11	10	11	10	11	10	47	88	88	89	88	88	88	88	182	954	4.320
240	3	4	6	11	10	11	11	10	11	10	11	10	69	88	88	88	88	88	88	89	182	976	4.292