



West Wind Explorer

The
Newsletter
Of The
MetroWest Dive Club
Framingham, Massachusetts



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Air Consumption:

By Fred Calhoun

No entirely satisfactory method of calculation for gaseous mixtures (like air, Nitrox or tri-mix) has been developed. However, the use of average constants is easy, and gives reasonable results under conditions considerably removed from the critical. The previous two sentences derived from Mark's Standard Handbook for Mechanical Engineers.

Air consumption calculations require an understanding of two difficult-to-get-a-good-grasp-on considerations. One is the Respiratory Minute Volume, the RMV - the amount of air moved in and out of the lungs in the process of breathing, during a minute's duration, at sea level. Understandably it varies - from hardly anything (0.25 cubic feet per minute while one is sleeping), to a refrigerator-stuffing 3 cubic feet per minute while running (generally only sustainable for an extended period of time by athletes - like marathon runners). We can tag a number on the RMV for starters - to be modified later. The average scuba diver probably moves 0.4 to 0.6 cubic feet of air per minute per atmosphere while scuba diving. We'll come back to that shortly. The other consideration is: how much air is in a scuba cylinder?

The amount of air in a scuba cylinder depends on a couple of factors. Proven by experimentation: a '3000 psi aluminum 80' scuba cylinder has an inner volume of about 0.39 cubic feet. The author and several accomplices diligently filled such a cylinder with water and carefully poured the water out into vessels of known capacities, and determined the inner volume to be 0.39 cubic feet. If the reader uses a cylinder other than a '3000 psi aluminum 80', he or she will need to remove the valve from the cylinder, fill it with water, and pour the water into vessels of known capacities to determine the actual inner volume. If you sense that the author does not trust published catalogs, or magazine ads, or sales people, you are right. There are 7.48 gallons in one cubic foot. So - add up your measuring cups and determine how many gallons your cylinder holds. Those gallons divided by 7.48 will yield the cylinder's actual inner volume in terms of cubic feet.

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Meetings This Month

Tue. January 13th– Bob Foster—Diving the “Titanic” of New England

Tue. January 27th - Social Meeting

Crowne Plaza Hotel, Rt. 9 Natick MA

Social Hour: 6:30-7:30 (In the bar) Meeting Begins: 7:30 Sharp

West Wind Explorer

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The *West Wind Explorer* is a monthly publication of the MetroWest Dive Club. It is distributed electronically to members prior to the club's first meeting of the month. Club meetings take place on the second and fourth Tuesday of each month.

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We encourage authors to submit original articles and photographs for publication. Contributions to the *West Wind Explorer* are considered to be positions of the authors and do not necessarily represent the opinions or positions of the *West Wind Explorer* or MetroWest Dive Club. Articles, contributions, and letters-to-the-editor should be sent by postal mail to:

**MWDC Editor,
C/O Bill Borek
P.O. Box 1916
Framingham, MA 01701-1916**

Email contributions can be sent to:
editor@mwdc.org

Diving related classified advertising in the *West Wind Explorer* is **free** to all club members.

Editor's Plank:

Here it is. Enjoy

MetroWest Dive Club Board of Directors

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Alternates:

Georgios Kokovidis
 Rick Marshall
 Steve Picardo
 Louise Howard

The Officers of the club are available to answer your questions about the club or about diving. Please feel free to call them. The MetroWest Dive Club is dedicated to promoting fun, safe diving, and introducing and familiarizing members with new dive sites. We are committed to encouraging good relations with our coastal neighbors through courtesy and good diving etiquette, and getting involved in community activities. The club meets twice monthly on the **second and fourth Tuesday** of each month. Guests are welcome: divers and non-divers alike. The club can provide direction to the many training classes locally available. Join us at our next meeting or write to us: **The MetroWest Dive Club, PO. Box 1916, Framingham, MA 01701-1916**; email us at mwdc@mwdc.org; or visit our website at <http://www.mwdc.org>

Activities:

Rich Palanzi (508) 797-7027

Speakers:

Rick Marshall (617) 217-8165

Club Clothing and Merchandise

Louise Howard

Boat Dives:

Stephen Picardo (508) 839-5132

Shore Dives:

Roy Mennell (617) 721-3690

Ways & Means

Jim Nannery (508) 481-3006

Web Master

Bob Wilson

Speaker Alert:
MWDC presents
Diving the "Titanic of New England" by Bob Foster - Jan. 13 @ 8 PM
Crowne Plaza Hotel in Natick, MA



The Steamship Portland, lost with all hands in a devastating storm at the turn of the last century, was thought to be beyond the reach of scuba divers. In August of 2008, a group of Massachusetts divers pushed the boundaries of technical diving and visited this untouched wreck. Bob Foster will take you along on the first dives to the Portland, lost for almost 100 years after sailing into the "perfect storm" of November 26th, 1898. This elegant paddle-wheeler carried over 190 passengers and crew as it left India Wharf in Boston bound for Portland Maine, and was last seen as night fell off the coast of Cape Ann. The wreck was discovered in 1989 and positively identified in 2002, lying over 450 feet deep in what is now the Stellwagen Bank Underwater National Marine Sanctuary.

Join Bob and fellow divers Slav Mlch, Dave Faye, Paul Blanchette and Don Morse as they become the first to visit the Portland in 110 years.

Bob has been an active diver since 1972, and became interested in wreck diving while living near the Great Lakes in the 80's. He has been searching for shipwrecks in Massachusetts Bay for the last 8 years, and has discovered and documented over 15 including the YF-415, Brenton Reef Lightship, and Augustus Snow. In 2007, Bob was among the first divers to visit the Palmer/Crary wrecks, 360 feet below the surface in Stellwagen Sanctuary. Bob's wreck diving interests have also taken him to Lake Superior and to the Florida Keys, as well as to New York/New Jersey to dive the U-869 and the USS Spikefish.

Date@Eight
(Now @ 10 AM)

Schedule

Join us for our weekly Saturday morning dive on Cape Ann. All divers are welcome, members and non-members alike. Please contact the weekend's coordinator prior to showing up, so the crew doesn't leave without you!!

Coordinator for all dives this month:

Jan 3rd, 10th, 17th, 24th and 31st—

Roy Mennell
 781-891-3280 (Home)
 617-721-3690 (Cell)

Membership Info:

Due to unforeseen work requirements, the club's former membership coordinator was not able to keep the membership up to date on renewals and new member information.

The Board of Directors asks that you contact the new Membership Coordinator, Jim Nannery, if you think that your membership is due now or may be already past due.

Jim can be reached at membership@mwdc.org

Thank you for your patience.

Metro West Dive Club's 20th Annual Dinner-Dance & Awards Presentation

You, your family and friends are invited to

“A Night in the Tropics”

*Escape the winter blues for a night in straw hats, sundresses,
flowered shirts, shorts, flips flops or whatever!*

Saturday, February 7, 2009

Crowne Plaza Hotel
Route 9 East, Natick, MA
Cocktails 6:30 PM, Dinner 7:30 PM
Tickets \$40.00 per person



Dinner choices (TBD This Year)

Sirloin Beef with Chef's Special Tropical Sauce, Roasted Potatoes,
Fresh Seasonal Vegetables, Salad, and Dessert

Chicken Roulade with Chef's Special Tropical Sauce,
Fresh Seasonal Vegetables, Salad, Dessert

Vegetarian Tropical Delight, Salad, Dessert

Music, Dancing, Door Prize, Raffles, Cash bar
Family and friends are also invited

Underwater Photography display and contest,
Artifact display and contest,
Newsletter article contest

Annual Awards Ceremony: **Diver of the Year**, Diver recognition awards,
Most dives of 2008, and Achievement Certificates for divers making over 50
and 100 dives in 2008, Achievement Certificates for divers making lifetime
dive totals of 100, 200, 300, 400, 500 and more. Be sure to send your log
book entries to Rich Palanzi (e-mail them... he's a trusting soul) at
richard.palanzi@yahoo.com).



Tickets must be purchased in advance and will be on sale at
all meetings prior to the banquet. Purchase your tickets online
at www.mwdc.org. They may also be ordered by contacting:
Rich Palanzi at 508 797-7027 or
richard.palanzi@yahoo.com

The Crowne Plaza is holding rooms at a special rate TBD. Contact Rich for the
code to reserve a room at that rate. After that date, the discounted price will still
be honored if room availability still exists.

Upcoming Shows:

NAUI and The Underwater Club of Boston

present

The Boston Scuba Show The 58th edition

Feb. 28, 2009 (10a.m. to 3p.m.)

Holiday Inn, Marlboro, Mass

Jct rtes 495 and 20

FREE PARKING

directed by Alan Budreau

THE FILMS OF JONATHAN BIRD

with Kerry Hurd

THE ANDREA DORIA

with Dave Clancy

The Birth of Technical Diving with The South Shore Neptunes and Small Hope Bay Lodge

by Fred Calhoun

The Illustrated Evolution of Scuba Gear

Paul Revere Spike Award to Andrew Martinez

THE LADY OF THE ISLAND

(new film by Chris and The Captain)

Tickets at \$15 (use the savings for gas) at the door or in advance by writing to

Cecile Christensen, 2 Ocean Ave (1-H), Gloucester, MA 01930

Show phone (with a machine) 1-978-525-3432

Checks payable to: Cecile Christensen

For Sale:

Camera Supplies for Sale

35mm body Minolta XTsi – Best Offer

Lens \$50 each

70-210mm Quantaray 1:4.7 macro 55mm
1:4-5.6

28-80mm Minolta 0.38m/1.3ft macro 62mm

Quantaray filters \$5 each

62mm circular polarizer

62mm diffusion

62mm skylight 1A

55mm polarizer

55mm UV haze

55mm cross screen

Please contact Karen at sharkbait202@aol.com
or 508-272-5098

Mares regulators for sale for \$70 (negotiable)

Atomic Split fins for sale for \$50 (negotiable).

Can be seen @ <http://www.cs.umb.edu/~bobw/FS/>
Contact Bob Wilson at Robert.Wilson@umb.edu

**MWDC members may list items for sale.
Please send your ad copy to the Newsletter
Editor to have your items listed at no charge**

Aqua Lung Recalls Scuba Regulators and Adapters Due to Drowning Hazard

WASHINGTON, D.C. - The U.S. Consumer Product Safety Commission, in cooperation with the firm named below, today announced a voluntary recall of the following consumer product. Consumers should stop using recalled products immediately unless otherwise instructed.

Name of Product: Titan DIN 1st Stage Scuba Regulators and Titan/Conshelf DIN Scuba Adaptors

Units: About 6,000

Manufacturer: Aqua Lung USA, of Vista, Calif.

Hazard: Over-tightening of the DIN retainer by a technician during installation can result in the retainer breaking under pressure, a rapid escape of air from the scuba cylinder, and the regulator detaching from the scuba cylinder. This poses a drowning hazard to divers.

Incidents/Injuries: The firm has received one report of a DIN retainer breaking under pressure. No injuries have been reported.

Description: The recalled regulators have a brass DIN retainer manufactured prior to June 2006. The recalled Aqua Lung Titan Din 1st Stage regulators have serial numbers lower than 6062501 stamped on the side of the regulator's body. Recalled Titan/Conshelf DIN adaptors are marked "300 BAR MAX" on the side of the part. DIN adaptors marked "300 BAR MAXI" are not included in this recall.

Sold at: Authorized Aqua Lung dealers nationwide from January 1997 through September 2008 for about \$300 to \$450 for the scuba regulators or \$70 for DIN adaptors sold separately.

Manufactured in: France

Remedy: Consumers should immediately stop using the recalled diving regulators and DIN adaptors and return them to any authorized Aqua Lung dealer for a free replacement DIN retainer.

Consumer Contact: For additional information, contact Aqua Lung toll-free at (877) 253-3483 between 8 a.m. and 5 p.m. PT Monday through Friday, or visit the firm's Web site at www.aqualung.com

Recent Meeting Minutes:

By Laurie Borek, Secretary

December 2, 2008 Board of Directors Meeting in Review

Jim Nannery hosted this meeting.

Topics discussed were:

- DAN donation in memory of George Purofoy
- New Projector needed
- Wrecks 2008
- Wrecks 2009 – Nov. 7, 2009
- Dinner Dance
- Membership

January 6, 2009 Board of Directors Meeting in Review

Jeff Wagner hosted the meeting.

Topics of concern were:

- DAN donation
- Pay Pal
- Wrecks 2008 follow up
- New Projector
- Wrecks 2009
- Royal Order of Neptune
- Tropical Dinner Dance
- Web site
- BOD membership
- MWDC membership



Minutes from the December 9, 2008 MWDC Meeting

Tony Karis opened the meeting at 7:45.


18 people attended this meeting.

We discussed:

- Tropical Dinner Dance is Feb 7 at 6:30. Tickets are on sale at meetings and on Pay Pal for \$40. Photos, artifacts, interesting finds and diving milestones will all be on the agenda. Diver of the year nominations were taken. Attendees are encouraged to bring something, not necessarily dive related, for our raffle. Bob Storme will DJ the evening.
- A donation of \$100 to DAN in George Purifoy's memory passed a vote.
- Wrecks will be Nov. 7, 2009 at Keefe Tech
- Tony will order new black MWDC watch caps, to be sold at \$10-\$12.
- Alexine's been in the water
- Karen asked if anyone was interested in skiing

Our own, Mike Walsh spoke and shared his amazing photos of Lembah Straight, Indonesia. It was an interesting and beautiful presentation.

January Tide Tables - Gloucester Harbor

DAY	DATE	HIGH				LOW					
		AM	hgt	PM	hgt	AM	hgt	PM	hgt	rise	set
Friday	02	2:42	8.4	2:54	8.7	8:43	1.0	9:07	0.5	7:12	4:21
Saturday	03	3:25	8.6	3:43	8.4	9:32	1.0	9:53	0.6	7:12	4:21
Sunday	04	4:12	8.8	4:36	8.2	10:26	0.9	10:44	0.8	7:12	4:22
Friday	09	8:54	10.5	9:39	8.9	2:35	0.2	3:22	-1.1	7:12	4:28
Saturday	10	9:51	10.9	10:35	9.2	3:32	-0.2	4:17	-1.5	7:11	4:29
Sunday	11	10:47	11.1	11:28	9.6	4:28	-0.5	5:10	-1.8	7:11	4:30
Friday	16	2:52	9.6	3:13	9.2	8:55	-0.1	9:19	-0.1	7:09	4:36
Saturday	17	3:43	9.3	4:09	8.6	9:51	0.3	10:10	0.6	7:08	4:37
Sunday	18	4:36	9.0	5:07	8.0	10:49	0.7	11:04	1.1	7:08	4:38
Friday	23	9:06	8.8	9:47	7.7	2:42	1.6	3:30	0.7	7:04	4:44
Saturday	24	9:51	9.0	10:28	7.9	3:28	1.4	4:11	0.4	7:04	4:45
Sunday	25	10:32	9.2	11:07	8.1	4:11	1.1	4:49	0.2	7:03	4:47
Friday	30	1:29	8.9	1:44	9.1	7:32	0.3	7:53	0.0	6:58	4:53
Saturday	31	2:08	9.0	2:27	8.8	8:16	0.3	8:35	0.2	6:57	4:55

Air Consumption -

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Simple mathematics will start us off on the road of discovery.

Boyle's Law; and considering an 'aluminum 80':

$$V1 \times P1 = V2 \times P2$$

$$\text{Free air vol.} \times 14.696 = \text{Cylinder vol.} \times 3014.696$$

01

$$V1 \times 14.696 = 0.39 \times 3014.696$$

$$V1 = 0.39 \times 3014.696 / 14.696$$

$$V1 = 80 \text{ Ft}^3 \text{ (easy enough, heh?)}$$

Launching a surgical approach: When air is used from a scuba cylinder, its final temperature will be 98.6 degrees F (98.6°F). That is the temperature it will be brought to inside our lungs. For air consumption calculations, that is the final temperature we should use in our arithmetic. In this work, we'll round 98.6°F up to 100°F for ease of mathematics. And that should be the typical temperature of a scuba cylinder following a slow and proper fill.

For air, the compressibility factor (Z) will be 0.9800 for 2250 psig, 0.9900 for 2400 psig, 1.013 for 3000 psig, and 1.045 for 3500 psig. The equation and manipulations are, for a 3000 psig 'aluminum 80', for example:

$$Z \times 53.34 \times 560\text{oR} / (3015 \text{ psia} \times 144) = \text{Ft}^3/\#$$

Z = Compressibility factor

53.34 = Gas constant for dry air

560oR = 100oF on the Rankine absolute scale

= Converts square inches to square feet

= Abbreviation symbol for 'pound'

Ft³/# = Specific volume (reciprocal of the specific weight)

'Z' was determined using the Nelson-Obert Generalized Chart.

Leaving off the 'units' to minimize clutter, (for an 'aluminum. 80'):

$$1.013 \times 53.34 \times 560 / (3015 \times 144) = 0.0697 \text{ Ft}^3/\#$$

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Air Consumption - Continued

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Air under those conditions, in a full aluminum 80', will weigh:
 $0.39 \text{ Ft}^3 \text{ cylinder space} / (0.0697 \text{ Ft}^3 \text{ per pound}) = 5.6 \text{ pounds}$;
 that's 5.6 pounds of air at a pressure of
 3000 psig and at a temperature of 100°F.

One pound of dry air (dried in the process of having been compressed to 3000 psig) would have occupied a space of about 14.11 Ft³ at sea level (we're almost at the end). 5.6 pounds of dry air at sea level conditions would have occupied:

$14.11 \text{ Ft}^3 \times 5.6 = 79 \text{ Ft}^3$ (so, it's called an 'aluminum 80').

02

Boyle's Law got us 80 Ft³ at 3015 psia. The surgical approach got us 79 Ft³. Although it is proper to consider that real gases do not follow Boyle's Law perfectly, it has been shown that even though the compressibility factor exists, and that it has some effect on things, and should be of interest, it really doesn't warrant a great deal of concern. Our calculations, using Boyle's Law, will yield usable results.

Find yourself in 33 feet of sea water (34 feet of fresh water) breathing from a cylinder of known capacity. An 'aluminum 80', or some such size, would be quite suitable. Fin swim at an easy pace for 15 minutes, carefully noting the cylinder's submersible pressure gauge indications at the start of the swim and at the end of the swim. Divide the pressure gauge psig difference by 15 (the number of minutes of the exercise). Your answer should fall somewhere around approximately 40 psig. Whatever your answer may be, divide it by '2', and that will be your surface Respiratory Minute PSI. Suppose you consumed 600 psig during that 15 minute swim, and suppose that the cylinder was a 3000 psig 'aluminum 80'.

$600 \text{ divided by } 3000 = 0.20 \text{ (20\%)}$.

$0.20 \text{ times } 79 \text{ cubic feet} = 15.8 \text{ (use } 16) \text{ cubic feet}$.

16 cubic feet consumed in 15 minutes means that your surface equivalent air consumption rate would be:

$16 \text{ cubic feet} = 0.5 \text{ Ft}^3/\text{min (+/-)}$

$15 \text{ min} \times 2 \text{ atmos}$

Having consumed 600 psi from the cylinder at 33 fsw, you would have consumed only 300 psi at the surface, all else being equal. 300 psi in 15 minutes equates to about 20 psi per minute at the surface. Such values are representative and are specific to the individual and the cylinder being used.

33 feet of sea water was chosen for the exercise because doing it at the surface would have involved wave making and fin splashing - two inefficient efforts which would have affected the respiratory rate and also would not have been duplicating actual diving conditions.

It is quite impossible to gauge the consumption of air from a scuba tank in terms of cubic feet per minute. The more readily observable phenomenon is that of pressure gauge readings. As a scuba diver breathes from his or her scuba unit, the observable pressure of the re-remaining air in the cylinder gets lower and lower. So - the gauge does not tell you how many cubic feet of air you've breathed, but it certainly does give an honest indication that some air has been used, and that some is remaining.

Just as how deep one descends isn't a measure of a diver, neither is how fast or how slow one consumes air a measure of a diver.

If one contrives to carry massive (heavy) equipment while scuba diving he or she will consume more air in the process than if he or she went in with less. Some scuba divers believe that if they are 'neutral' in the water (if they neither sink to the bottom nor rise to the surface) that the mass of what they wear/carry is of no consequence. Those divers are mistaken. The more things one lugs through the water the more work that effort requires, and the more air he or she will consume.

Scuba is not a competitive activity; scuba divers seldom race about underwater. When an individual has learned his or her RMPsi, and has logged some dives keeping track of it, the more successful that person will be as a scuba diver. Knowing how long a particular scuba cylinder will last when full, or partly full, is valuable information.

The Respiratory Minute Rate in psi per minute per atmosphere (the RMPsi) is cylinder related. For example, two cylinders, one half the size of the other (like a '40' versus an '80'), will display different psi drops as air is breathed from them. The psi drop experienced by the larger cylinder (twice as big) will be half that displayed by the smaller cylinder

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Air Consumption - Continued

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When breathed from by the same person, all other conditions being equal (same depth, same work rate, etc.).

We are all going to be relieved when the author decrees that using 15 psi when measuring atmospheric is as acceptable as using 14.696 psi. In all our calculations, there are small errors allowed. Remember, we started by saying, "Find yourself in 33 feet of water..." for making the initial consumption measurements. Who can find himself or herself in exactly 33 feet of water, and stay there unerringly for a 15 minute fin swim session? Not many can. So - in our calculation answers there will always be the term, '...about...'. All our calculations will give us answers which will be 'about' right.

What about your tank?

Fill your cylinder with water and measure its inner volume in gallons. Divide the gallons by 7.48 to convert to cubic feet. Write that 'Ft3 inner volume' value in the formula/equation below this paragraph. Multiply that value by the rated pressure of the cylinder with 15 psi added to it. Divide that answer by 15 psi. The result will be about the amount of free air in cubic feet contained at the rated gauge pressure.

Ft3 inner volume x (rated psig plus 15) = Ft3 of air contained
15

Each diver should determine his or her RMPsi (respiratory minute psi) for each size cylinder he or she uses regularly.

And, there you have it.