

Calculating SCR (Surface Consumption Rate)

How long will a tank last you at a given depth? Here's how to find out.

When you know your SCR in cubic feet per minute, it's possible to estimate how long a tank will last you at a given depth.

Many divers routinely check their surface consumption rate (SCR) in psi, which is a good measure of breathing efficiency. However, if you calculate your SCR in cubic feet per minute (cu. ft./min.), you'll have a functional number that will allow you to estimate how long a given cylinder of air will last you at any depth.

Getting Started

As with any SCR calculation, you first need to establish a base consumption figure. Okay so how long can you stay down. Well the first thing we have to do is calculate our surface consumption rate (SCR). The rate at which we breath air at the surface. How do we do that? Well the best way to do it is to pick a specific depth in the water, lets say 33 feet. Then stay there at feet and breath normally for 10 minutes. Record the tank pressure at the start of the 10 minutes and again at the end of the 10 minutes. Once we have all that information we can find out our SAC (Surface Air Consumption) rate. Thirty-three feet for 10 minutes is a good choice and makes the calculations a little easier. Watch your submersible pressure gauge, compass, depth gauge and watch or timer. Better yet, use a gas-integrated dive computer and all but the compass will be contained in one instrument. Kick out five minutes and back five minutes at roughly your normal dive pace. This is also a good time to check your navigation skills.

Math Class

Now you're ready to convert psi to cubic feet.

Step 1 -- Establish the volume of air in cubic feet that you started with. This is easy if you know the volume of your tank and it is full (see "Tank Chart Below"). Keep in mind, most standard aluminum 80 tanks hold 77.4 cu. ft. at 3000 psi. To find the actual volume of a less-than-full tank, divide the actual pressure by the full pressure and multiply by the volume in cubic feet of a full tank.

EXAMPLE

What is the beginning volume of a standard aluminum 80 at 2800 psi?
 $(2800 / 3000) \times 77 = 72 \text{ cu. ft.}$

Step 2 -- Calculate the cubic feet of air used during your test run. The process is similar to Step 1: Divide the ending pressure by the beginning pressure and multiply your answer by the starting tank volume in cubic feet. Subtract that figure from the starting volume to get the volume of air used during the dive.

EXAMPLE

How many cubic feet of air did you use if you began your test dive with 2800 psi and finished with 2300 psi?
 $(2300 / 2800) \times 72 = .82 \times 72 = 59 \text{ cu. ft. remaining}$

$72 - 59 = 13 \text{ cu. ft. used during the dive}$

The next thing we need to do is convert our depth into atmospheres. That is done by using the formula:

EXAMPLE

$$\frac{(\text{Actual Depth} + 33 \text{ feet})}{33 \text{ feet}} = \text{ATM}$$

So in this case

$$\frac{(33 \text{ feet} + 33 \text{ feet})}{33 \text{ feet}} = 2 \text{ ATM}$$

33 feet plus 33 feet equals 66 feet. Divide 66 feet by 1 ATM of 33 feet and this equals 2 ATM

Step 3 -- Convert to cubic feet per minute for your SCR.

EXAMPLE

Your test dive was 10 minutes at 33 feet. Since 33 feet is two atmospheres of pressure, divide cubic feet of air used by two, and then divide that by the number of minutes. You end up with your SCR in cubic feet per minute (cu. ft./min.).

$$(13 / 2) / 10 = 6.5 / 10 = .65 \text{ cu. ft./min. at the surface}$$

13 cu. ft. used during dive is divided by the 2 ATM for your depth of a 33 foot dive then equals 6.5

and divide your 10 minutes of dive time into this to equal a consumption rate of .65 cu. ft. per minute at the surface

So What? The Practical Application

Congrats, you passed math class. What do you do with this knowledge? Now that you know your SCR, it is possible to estimate the length of time a tank will last you at a given depth.

Step 1 -- Divide the volume of any tank by your personal SCR:

Lets do a dive on an 80 Aluminum cylinder to 75 feet.

Take the actual cu. ft. of the tank (use the "Tank Chart") and divide this by your SCR.

$$77 \text{ cu. ft.} / .65 \text{ cu. ft./min.} = 118 \text{ minutes}$$

Step 2 -- Divide by depth in atmospheres:

$$75 \text{ foot dive} + 33 \text{ Feet} = 3.3 \text{ ATM}$$

$$118 \text{ min.} / 3.3 \text{ ATM} = 35 \text{ minutes}$$

Congratulations!

You now know that on a dive to 75 feet, a full aluminum 80 cylinder would last you about 35 minutes. Since you must allow time for descent, ascent, a safety stop and a reserve of 300 to 500 psi, a bottom time of no more than 25 minutes would be practical for you. Such specific information can help you more accurately plan your dives, decompression stops, and select a dive buddy, if you dive with one.

Tank Chart

	Cylinder Size (cu.ft.)	Actual Capacity (cu.ft.)	Max. Service Pressure (psi)	Outside Diameter (in.)	Length (in.)	Weight Empty (lbs.)	Salwater Buoyancy Empty (lbs.)	Saltwater Buoyancy Full (lbs.)
ALUMINUM	13	13.2	3,000	4.4	12.9	5.9	-0.7	-1.7
	14	13.7	2,015	4.4	16.5	4.4	1.7	0.7
	19	19.9	3,000	4.4	18.6	8.1	0.1	-1.4
	27	27.6	3,000	5.3	18	11.4	0.6	-1.5
	30	30	3,000	4.9	21.9	11.6	1.2	-1
	40	39.9	3,000	5.3	24.8	15.2	2.2	-0.8
	50	48.4	3,000	6.9	19	21.1	1.3	-2.4
	63	63	3,000	7.2	21.9	26.6	2.6	-2.1
	72	69.6	3,000	6.9	26	28.4	3.6	-1.6
	80	77.4	3,000	7.2	26.1	31.3	4.4	-1.4
STEEL	92	90.3	3,200	8	24.8	37.6	3.1	-3.6
	100	99.3	3,300	8	26.2	40.8	3.1	-4.3
	45	45	2,640	5.5	23	17.6	0.8	-2.4
	65	65	2,640	7	21.1	25.6	0.1	-4.5
	80	78	2,640	7.25	23.2	30	0.7	-4.7
	95	95	2,640	8	23.8	37.3	2.4	-4.4
	108	108	2,640	8	26.8	41	3.4	-4.4
	120	120	2,640	8	29.3	45	4.3	-4.5
	60	60	3,300	6	22	22.9	-2.8	-6.8
	72	72	3,300	6.75	20.5	28.7	-3.7	-8.4
80	80	3,500	7.25	20.1	32.4	-7.3	-13.2	
100	100	3,500	7.25	24.2	38.8	-7.5	-14.8	
120	120	3,500	7.25	28.6	45.4	-7.7	-16.6	