Re-thinking Thirds

by Steve Trewavas

Thirds

The rule of thirds, the recognized cave diving gas consumption rule, solid, safe and consistent, right? During this short article I hope to challenge your beliefs and encourage each of you to think further about the subject. Many of us have come to the realization that in a lot of situations thirds is simply not enough and more conservative back gas planning is prudent. This becomes even more crucial during stage diving and here in this article I specifically want to address and pass on an alternative method of stage tank diving.

The accepted method of stage diving has been to breathe the bottle down to 1/3rd drop the bottle and revert to using your twins. Turn when you reach a 1/3rd of your back gas pressure and exit the cave, collecting your stages as you leave.

Thirds is the absolute minimum gas rule allowable for cave diving. If a diver and his buddy get in trouble at maximum penetration this method theoretically should get them out. In reality it would be a very close event. Factors such as increased stress promoting greater gas consumption, time used to fix the problem and the slower swim time utilized whilst gas sharing, will affect the outcome. A trained diver exiting a cave system, without lights, is approximately 4 times slower than when unburdened by failures. An untrained diver is approximately eight times slower, a sobering thought!

Firstly let us define a stage tank, which I see commonly confused with a decompression tank. A stage tank is utilized as gas to penetrate into a system, included in your back gas calculations, if you like. Decompression tanks on the other hand, generally containing nitrox or oxygen and are used primarily to accelerate decompression times.

Half Plus 15 Bar

This is the new method presently becoming popular in the United States and promoted by GUE/WKPP divers throughout the world. In short it is a method that uses 1/3rd of your total gas supply after breathing your stage tank to half plus 15 bar. The extra 15 bar is included as a means of not draining the tank fully and allowing an extra margin for gas switching. Additionally at considerable depths you may find the last 15 bar in a tank can not be breathed due to the complexities of Boyles Law.

This is basically a clever method of redistributing your gas by considering your gas as a total figure rather than as individual tanks. At all times prior to turning the dive you should have at least two thirds of your gas supply in your back tanks, untouched and available for use.

The simplest example of this method is to imagine you are conducting a dive utilizing cylinders all of the same size and fill pressure. Twin manifolded 11 litre (80cft) cylinders on your back and an 11 litre (80cft) stage tank all filled to 210 bar.

Calculate 1/3rd of your 11 litre (80cft) stage tank gas;
210 bar divided by 3 = 70 bar,
Which is; 70 bar in, 70 bar out, 70 bar in reserve,
70 bar X 11 Litres = 770 Litres.
The reserve gas of your stage tank is always retained in your twins.

Calculate equivalent pressure in your twins of this RESERVE of the stage tank
Twin 11 Litre cylinders (80cft) are calculated as 22's
(This is the volume per bar of the twin 11's aka 11 x 2 =22)
770 litres divided by 22 litres = 35 bar.
Reduce usable pressure in your twin cylinders by the 35 bar which is NOT USABLE since it is the stage cylinder reserve
Twins: 210 bar - 35 bar = 175 bar
You now have 175 bar USABLE to calculate thirds in your twins
175 bar, for simplicity rounds down to
165 bar divided by 3 = 55 bar

Which is: 55 bar in, 55 bar out, 55 bar reserve
You have 55 bar to penetrate from your twins.

Calculate your twin tank turn pressure using the original starting pressure of 210 bar;
210 bar - 55 bar = 155 bar turn pressure in the twins
When pressure reaches 155 bar in his/her back gas the diver must turn and exit the cave.

Breakdown: 55 bar in, 55 bar out, 55 bar in Reserve, 35 bar reserve (stage),
Total = 200 bar,
(unaccounted for 10 bar is from the rounding to calculate 1/3rds)

Gas Management Summary:
Stage cylinder drop at half + 15 bar
210 divided by 2 = 105 bar,
105 bar + 15 bar = 120 bar - drop.
Twin cylinders;
210 bar - 55 bar = 155 bar turn.

This method has a number of positives, primarily it keeps a greater amount of usable gas in your back tanks, becoming ultimately more conservative. When utilizing the Half Plus 15 Bar method during an emergency, as the stage tanks are drained, you would simply discard them. This has the benefit of not adding to your gear configuration and creating extra drag and clutter for a diver who is at risk of being overwhelmed with an increasing number of compounding problems. In any out of gas situation it is essential to exit as expediently and safely as possible and to further this; the more streamlined a diver the better.

In the traditionally accepted 1/3rds method a diver could not discard a tank which contained any gas, so would be obliged to drag them all with him. Due to the extra weight, complication and complexity of swimming with a number of stage tanks the divers' retreat would undoubtedly be slower, necessitating usage of even more precious gas.

So let's look at a gas sharing scenario under both methods:

Catastrophic Failure using Thirds

For whatever reason one diver has a total gas failure at maximum penetration. He signals his buddy who donates his long hose and the divers turn for the entrance. As the divers exit the cave they come across the first of their usable stage tanks. By now one diver is totally out of air and the other is now basically in the same predicament. They have both used the two remaining thirds to reach their stage tank. Both divers being totally out of back gas, collect their stages and commence breathing them. As they swim up to collect their second stage bottle they have drained the stage they are breathing until one last third remains. The divers dare not discard the tank as that last third may become critical. Each diver adds his second stage tank to his gear configuration and continues swimming clumsily along with two stages rattling around beside them, slowing them even further in their distressed state.

Catastrophic Failure using Half + 15

How would you feel about your buddy having additional gas in his twins at your gas failure point due to the fact that at your furthest penetration you both had a greater turn pressure in your twins anyway? You swim back sharing air to the first of your two stage tanks. Your back gas is not threatening to run out on the out of gas diver at any moment. You are in much better shape gas wise, as you arrive at your first stage tank. Here you each collect your respective stages and commence breathing them back to where you placed your second stage tanks. As you arrive at your first cylinder drop you have 15 bar of gas left in the first stage tank. It is practically empty, so you discard it leaving it in the cave, collect the remaining stage and swim carrying one bottle as efficiently as you can for the entrance.

I have also found this method far more practical during expedition diving where less tanks and gas mixing is required. At the end of a dive you don't have a third of your gas remaining in a number of stage tanks. Theoretically you should only have 15 bar, practically an empty tank,

which you simply drain and remix.

I hope some of you will consider this method as a clever and safe alternative to the more traditional stage diving protocol. Lastly the usual word of warning. Before adopting this method and setting off for the end of some line, please take the time to fully understand what I have briefly explained above and if unsure, please just ask.