

Gas Matching

Dissimilar tank volumes

By: Jim Wyatt
NSS-CDS Instructor #355



- Two dive buddies are diving with dissimilar volume tanks, one buddy has double Low Pressure 104's and one buddy has double Low Pressure 85's. Both sets are filled to 3600 psi.
- If both divers ignore the fact that their tanks are different volume they will breathe unequal volumes of gas if they calculate their turn point based $\frac{1}{3}$ of their pressure.
- They must ensure that they each calculate the turn around point based on VOLUME and not simply pressure.
- This presentation is designed to show you how to accomplish this.

Tank Baseline Calculations

- ▣ Step one is to calculate how many cubic feet of gas is contained in each 100 psi of gas in the tanks.
- ▣ The formula is:
 $(\text{Rated Volume divided by Rated Pressure}) \times 2 \times 100 = \text{Baseline}$
- ▣ So for LP 104's the calculation is→
 $(104/2640) \times 2 \times 100 = 7.8 \text{ FT}^3 \text{ per } 100 \text{ psi}$
- ▣ For the LP 85's $(85/2640) \times 2 \times 100 = 6.4 \text{ FT}^3 \text{ per } 100 \text{ psi}$

- ▣ SO: LP 104's are 7.8 cubic feet per 100 psi
- ▣ And: LP 85's are 6.4 cubic feet per 100 psi

Matching Volumes

- ▣ The smaller tanks are the controlling tanks in that the diver using the LP 85's can use 1/3 of their pressure for their turn volume/pressure
- ▣ SO: $3600 - 1200 = 2400$ psi
- ▣ SO The turn pressure for this diver is 2400 psi
- ▣ The volume that diver uses is calculated by:
 $12 \times 6.4 = 76.8$ cubic feet---in other words that diver can use 76.8 cubic feet of gas before s/he has to turn the dive.

Matching Volumes

- ▣ Now we must calculate the turn pressure for the diver on the 104's – we know that diver can only use 76.8 cubic feet, but we must convert that to how much pressure that equals.
- ▣ The formula is: $\text{Small Volume} / \text{Big Base} \times 100$
- ▣ SO: $(76.8 / 7.8) \times 100 = 984$ which means the diver on the 104's can use 984 psi –OR– a turn pressure of $(3600-984)= 2616$ psi.

Prove It

- ▣ The proof is again in the math→
- ▣ $9.84 \times 7.8 = 76.75 \text{ FT}^3$
- ▣ In other words the LP 104 diver can use 9.84 hundreds (which is converted into units of 100 psi) which is $9.84 \times 7.8 = 76.75 \text{ FT}^3$

The Pitfall Of Not Gas Matching

- ▣ In the above example lets look at the problem with each diver simply using pressure to calculate when to turn their dive.
- ▣ If the diver on 104's uses 2400 as the turn pressure they will have used
 $12 \times 7.8 = 93$ FT3 of gas, and will need 93 FT3 of gas to exit the cave. So a total of 186 FT3 of gas needed to complete the dive. This diver is beginning the dive with 280 FT3 of gas.
 $36 \times 7.8 = 280$

The Pitfall Of Not Gas Matching

- ▣ The diver on the LP 85's has a complete system failure at max penetration as they hit their turn pressure on 2400 PSI.
- ▣ That diver will have used $12 \times 6.4 = 77$ FT³ of gas to get in and will need another 77FT³ of gas to get out.

The Pitfall Of Not Gas Matching

- ▣ A total of $77 + 93 = 170$ FT³ of gas will be needed to get both divers out. Is there enough?
- ▣ The 104's failed at max penetration and both team members must come out on the LP 85's.
- ▣ Since the LP 85's are at 2400 psi the remaining gas volume is: $24 \times 6.4 = 153$ FT³
- ▣ SO: There is NOT enough gas to exit even if the divers SAC rates do not increase to the emergency situation they are in.