**Continuous Blending:**
With the proper mixing chambers, heliair can be pumped directly through a standard compressor.

**Disadvantages**

**Best Mix:** In trimix, a PO2 of 1.4ata and an equivalent narcosis depth of 130 feet are desirable. With heliair, to obtain an equivalent narcosis depth of 130 feet, a PO2 of 0.9 to 1.1ata must be accepted — far below the desired 1.4ata PO2. If a PO2 of 1.4ata is obtained then an equivalent narcosis depth must be accepted, much deeper than the desired 130 feet.

**Increased Decompression:** Due to the fact that optimal PO2s of 1.4 are not obtained, decompression requirements will increase slightly compared to that of the Best Mix.

**Partial Pressure Mixing**
Two basic formulas are required to mix heliair. The first formula is used to determine how much helium in psi is needed for a desired mix. \( FHe \times \text{Ending Pressure, where } \) \( \text{HE stands for fraction of helium.} \)

Example: A ending helium percentage of 24% is desired with an ending pressure of 2640 psi. Formula: \(0.24 \times 2640 = 633 \) psi helium to be added. The second formula gives the oxygen percentage in the cylinder after topping off with air:

\( 1 - FHe \times 0.21 \) Example: The oxygen percentage in the above 24% mix would be

(1 - 0.24) \times 0.21 = 0.159 or 15.9%

The mixing process is relatively simple. First drain the scuba cylinder then bank the required psi of helium into the scuba cylinder. Allow time for the helium to cool and the pressure to drop then make the necessary corrections. Fill the scuba cylinder with air to the desired ending psi. Analyze the oxygen content with an O2 analyzer. If the oxygen percentage is too low just add more air until the mix is correct. Always round the oxygen percentage down (Example 15.6% to 15%) to the next lower number this will add a small amount of safety to the decompression tables.

**Analyzing**
It is imperative to analyze your gas right after mixing and then again just before the dive. You should calibrate the analyzer to air (20.9%) and not 100% O2. This will decrease the range of error for the analyzer. Alternate tables or a laptop with decompression software such as Abyss, Voyager, Decom, etc. should be available. On-site to recalculate tables in the case of a gas change.

**Saving Helium**
Due to the high cost of helium, divers try to save every drop. If multiple heliair dives are to be conducted over several days the helium left in the scuba cylinder after a dive can many times be saved. This is done by calculating the helium psi still in the scuba cylinders then adding more helium on top of it. Example: heliair 14% O2 / 33% was used on the first dive. Upon returning to the surface the diver has 800

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**HeliAir Fill Chart (PSI)**

| HEl | 19 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| O2% | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |
| PSI | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 |

This chart provides the amount of helium to add (in psi) to an empty scuba cylinder to create the various heliair mixtures. First, find the desired heli-air mixture to the left, then the ending scuba cylinder pressure at the top, intersect these two rows to get the required helium (in psi). Then top off the tank with air. You can also use the chart to determine the amount of helium left in a cylinder after a dive. Many times this helium can be saved.

Illustration: C. Bowen
This chart gives the Equivalent Narcosis Depth (END) in ftawn, and the partial pressure of oxygen (PO2) in atmospheres absolute for various helium air mixes. Match up the desired depth with the desired END or PO2. Once located, the desired helium and oxygen percentages are in the left black box. The helium fill psi from 2600-3600 psi are located in the same black just above the depth row.

psi of mix left in his cylinders. The amount of helium in psi still left in the mix can be calculated by taking the fraction of helium times the pressure left in the cylinder. 0.33 x 800 psi = 264 psi of helium still in the scuba cylinder. Let's say the next dive requires a heli-air mix of 15% O2 / 28% He. If the cylinders were empty, 739 psi (0.28 x 2640) of helium would be required to make the proper mix at 2640 psi but we have 264 psi of helium still in the cylinders from the first dive. Subtract the psi of helium still in the cylinders from the required psi of helium needed if the cylinders were empty. 739 - 264 = 475 psi of helium to be added on top of the 800 psi still in the cylinders then topped of with air to make the proper 5/28 mix. The only problem with remixing heli-air in this fashion is the higher bank pressures needed to remix. If the pressures get to high you will not be able to obtain the psi without a hank basket. The highest helium bank pressure available will determine if you will need to drain the left over mix in the scuba cylinders completely or just partially.

**Transfer Whip**
A transfer or fill whip is required to partial pressure fill helium from the bank cylinder to the scuba cylinder. All components of the whip must be designed for high pressure use. If the whip is going to be used for transferring pure oxygen then all components must be oxygen compatible and free of hydrocarbons. A whip can be purchased whole and ready for use or the components can be purchased and assembled. The following is a list of whip components.

**Connector:**
An industry standard CGA-580 style connector is required for the helium bank cylinder. Note a CGA-580 to CGA-540 adapter can be purchased to convert an oxygen whip into a helium transfer hose.

**Line Filler Valve:**
A needle valve is used to control the rate of flow from the bank helium to the scuba cylinder. Transferring any gas for mixing should be done slowly to help minimize heat build up which can cause an error in the final mix. The best in-the-field technique is to place your ear on the scuba cylinder and crack the needle valve until you can hear the gas flowing.

**High Pressure Hose**
High pressure hose 3-6 feet in length is sufficient.

**Pressure Gauge**
Pressure gauges come in a variety of sizes, styles and pressure readings. Digital gauges are recommended but due to their high cost most brewers use analog. Digital dive computers with integrated pressure gauges work very well.