



GAS TRANSFER DEVICES FOR YOUR EVERY NEED

by

Dr. Richard Boyd and Greg Kent © 2005

The current era of burgeoning TEK diving has created a significant demand for gas transferring and blending apparatus. With this demand has come some confusion over the terminology associated with these devices as well as their appropriate uses. TRANSFILLERS are simply two tank valve connectors linked by a Teflon-lined hose which allow dive tanks or other special-use vessels to be filled from commercial gas cylinders. A few hoseless models also exist for direct filling of small, pony-sized bottles from commercial vessels. Most common transfillers are unsuitable for gas blending operations because they lack certain design features considered essential for safe and accurate gas mixing.

GAS BLENDERS (or MIXERS) are highly specialized transfillers that incorporate the following important features: (A) A highly accurate gauge (usually $\frac{1}{4}$ of 1%) because precise measurements to about 10 psi are required to routinely obtain mixes that will analyze out within 1% of specification. The accuracy of gauges on common TRANSFILLERS is usually no better than 1% OR 400% deficient for precise gas blending. (B) All BLENDERS have check valves to prevent accidental cross-gassing or reverse flows during mixing operations (C) True BLENDERS have special valves designed to control and meter the composite gases into scuba tanks at slow rates. This is essential because oxygen can spontaneously ignite from adiabatic (compressive) heating generated by fast transfers, and the accuracy of any mix can be compromised by the heating / cooling effects caused by rapid transfer rates. (D) Well-designed blending apparatus usually have quick exchange devices on the various adapters needed to tap into the component gases, and also must be able to fill dive tanks fitted with either yoke or DIN-mode valves. **A “walk-through” on the use of a gas blender appears toward the end of this article.**

CAUTION: It is widely recognized today that mixtures of breathing gas are being produced in some facilities with substandard or jury-rigged apparatus. While successful mixes can often be obtained by experienced practitioners, this is not always true with amateur or “weekend blenders.” When one makes mixtures for sale to the public, any errant blend resulting from the use of substandard equipment could have serious legal consequences. Most recognized blending manuals and certification courses describe the accepted design parameters for blending equipment, so using cobbled devices to make mixtures for public consumption could place you in legal jeopardy if anything at all “goes wrong.”

CROSSOVERS are short transfillers to connect two scuba cylinders for the purpose of exchanging gases or equalizing pressures. They are available in DIN or yoke models and with or without content pressure gauges. As previously stated, crossovers and transfillers are usually not intended for blending operations. Sometimes they can have

limited use for that purpose, but only if pressure measurements or adjustments are verified with a suitably accurate gauge (0.25%). For example, a crossover might be employed after a dive to equalize the residual pressures of mixed gas within dive tanks, but the top-off procedure is carried out with a properly designed blending device.

Global Mfg. Corp. (GMC) manufactures a variety of transfillers, crossovers, gas blenders, and adapters for handling all common diving gases including compressed air and mixed gases. Most of our transfillers have 4-foot, Teflon-lined, stainless-braid hoses equipped with end adapters to fill scuba tanks (or medical bottles) from commercial storage vessels fitted with industrial CGA (Compressed Gas Association) valves. Handtite nuts and soft-seal nipples on our products permit swift attachment to respective industrial valves. Read on to see what we offer for various applications.

ALL of the devices built by Global Mfg. Corp. (GMC) are engineered for oxygen-service and are delivered oxygen-clean. They should be maintained in this status, stored in clean containers, and re-cleaned as needed. Transfillers / crossovers designed for air should NOT be used with oxygen because many components (like thermoplastic hoses with steel end fittings) may promote oxygen fires by releasing contaminants like oil or rust particles into the gas stream.

Recharging oxygen medical bottles fitted with CGA #870 ("DAN") valves is simple with GMC transfiller #45325. One end attaches to the commercial oxygen valve (CGA #540) and the other to the 2-pin medical oxygen valve on the small tank. An internal metering orifice promotes slow transfer of the gas that can be manually controlled by either tank valve. A 4,000 psi gauge monitors the fill pressure. Compact filler GMC #45241 is a direct, hose-less transfiller, handy for recharging small (pony-size) medical cylinders from industrial oxygen vessels. Like #45325, this transfiller contains an internal metering orifice to govern the rate of filling.

For delivering oxygen to scuba bottles, our #45245 connects commercial oxygen tanks (CGA #540) to scuba cylinders via a 4-foot whip and permits slow-filling through a metering orifice. Use this device to fill scuba tanks with O₂ for decompression purposes, rescue therapy applications, or to recharge rebreathers. As previously explained, #45245 lacks important design features required for accurate gas-mixing operations.

Transfillers #45261/45260 are for filling scuba bottles with helium. Like the #45245, these devices are for the "raw transfer" of gas, not for highly precise blending purposes. Because all inert gases belong to the same CGA class 580, the same transfillers used for helium also work for argon. This is a popular gas for filling dry suits during cold water diving because it greatly reduces the loss of body heat. GMC transfiller #45250 is another compact unit for filling pony tanks with argon.

Lastly, GMC also makes a variety of specialty gas cross-over devices for exchanging gases or equalizing pressures between scuba cylinders. These are oxy-clean devices with yoke (GMC #45340/341) or DIN (GMC #45345/346) end fittings connected by a 2-foot, Teflon-lined hose. Deluxe models (GMC #45341/346) have a 4,000 psi contents gauge.

For portable mixing purposes, one should consider purchasing the GMC #45465 Economy Gas Mixer. A superbly versatile device, this compact apparatus contains every feature necessary for safe and accurate blending of Nitrox or Trimix. Here's a walk through, showing how easy it is to make Nitrox: First, select the desired CGA adapter to tap the appropriate commercial gas supply, in this case, oxygen. Each adapter has a handtite nut and nipple that quickly mates to the respective tank valve, so you merely thread this fitting onto the oxygen tank valve. (Other supply adapters are included or available for other clean source gases such as air or helium.)

Next, a filling whip attaches to the supply adapter by means of a quick-coupler. This whip features a gauge to monitor the supply gas, a 5-foot Teflon-lined, stainless-braid hose (4,500 psi service) with a flow control valve on its free end. On this free end is another quick-coupler which mates to a bleeder-block sporting a battery-powered, electronic digital pressure gauge for mixing (0.25% accuracy) and a check valve to prevent gas back-flows. (Interchangeable fittings on the end of this block permit tanks with either yoke or DIN-mode valves to be filled.)

Oxygen can now be slowly and safely metered into the dive tank with great precision to the exact end point required for the specific mixture. Once that end point is achieved, simply close the all valves, drain the transfiller (bleeders are situated on either end of the whip) and switch it to your clean air supply, using the appropriate adapter. Add the precise amount of air required, and..presto...you have Nitrox...just that easy. The Economy Mixer can now be quickly dismantled and stored for future use.

#45465 was designed to fill one single tank (or double unit) at a time. However, a new adapter (GMC #45466) now allows two cylinders to be processed at once. Because of the physical laws ruling metering orifices, the permissible fill rates become progressively slower whenever additional tanks are added, but neither the effectiveness nor the accuracy of the mixing process is compromised. Try it ... you'll like it!



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