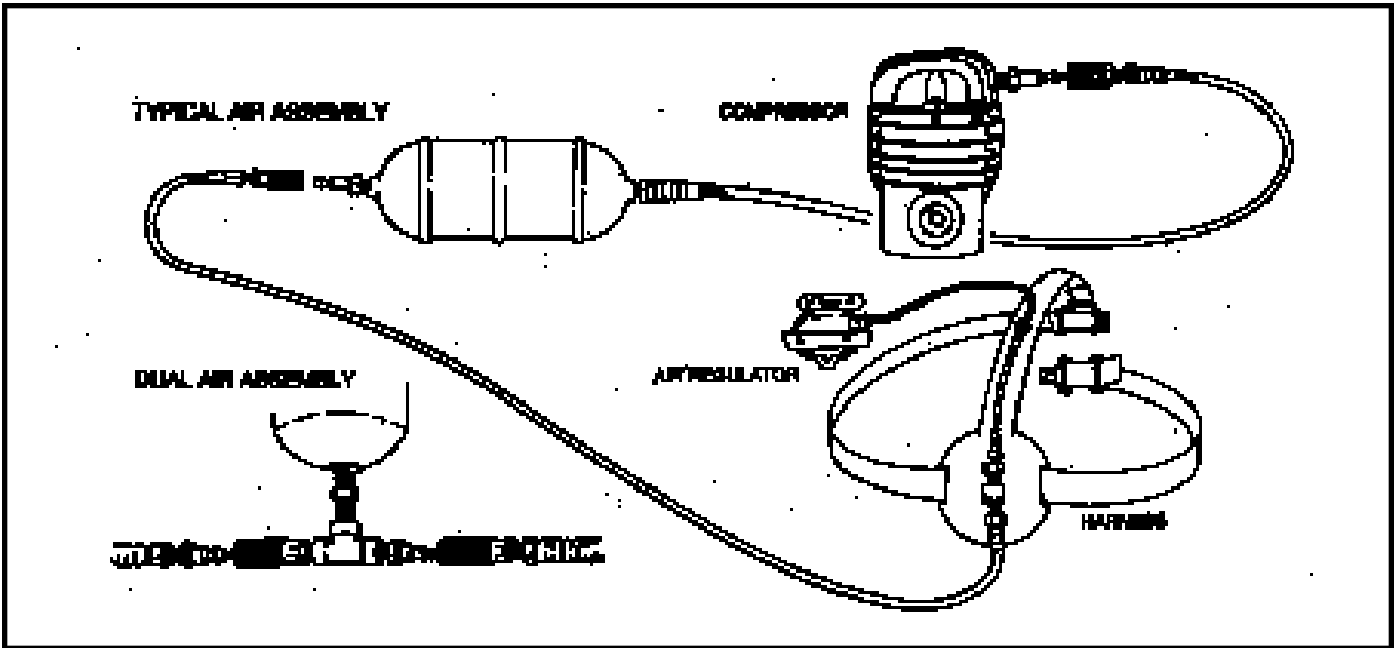


Introduction to Hookah Diving



There are two air supply systems that are used for underwater diving activities. One system, known as Self Contained Underwater Breathing Apparatus (SCUBA), involves the use of high pressure metal tanks which are worn on the diver's back while diving. The equipment used in SCUBA diving is quite technical in nature, and SCUBA gear should not be used by persons who have not become a certified diver involving expensive, specialized instruction. Without a certification card indicating completion of such a course, you cannot purchase compressed air.

Of course, the SCUBA air system has its advantages as well as its disadvantages. A diver using SCUBA gear is

usually "an entity unto himself," since he carries his life giving air supply on his back at all times. He can go anywhere he chooses, completely free of any ties with the world topside.

There are many times when an underwater diver does not need the total freedom that is afforded by the SCUBA air system, particularly in cases in which the diver is submerged in a limited area for long periods of time.

For these applications, the "Hookah" (Surface Air Supply) was invented. The Hookah air system uses no high pressure tanks of the type worn on a diver's back. Instead, it uses a small air compressor which is located at the surface. It is commonly powered

by a portable gasoline engine or electric motor, and the air is delivered to the diver via a floating air hose. With the Hookah system, the diver has an unlimited and nearly "cost free" air supply which will only stop flowing when the engine or motor that powers the compressor ceases to operate. This makes for a true economical air system, which will quickly pay for itself when compared to the cost of refilling a SCUBA tanks every hour or so.

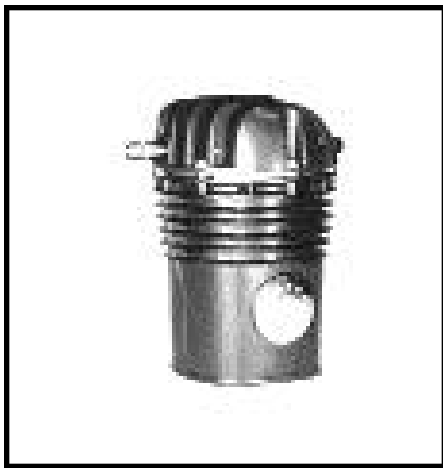
The only operating cost for a Hookah system is fuel, since the vast majority of Hookah compressor units are gasoline powered. It is not uncommon to get two hours diving time on a single gallon of gas, which shows just how

economical the Hookah air system can be.

Most Hookah divers will have a partner working "topside" as a safety man, and he can refill the engine's gas tank as it starts getting low. This will enable the diver to stay submerged so long as he desires.

THE AIR COMPRESSOR

The Hookah air system begins at the diver's air compressor. Hookah compressors are small,



Typical Hookah Air Compressor Model T-80

lightweight, and of simple design. They are commonly constructed of an aluminum alloy, and utilize a rubber diaphragm as the means of air displacement. There are also compressors that use a "piston" arrangement to displace air and these types generally deliver more air at higher pressures than the diaphragm models. The moving parts inside a Hookah compressor are lubricated with Teflon for the life of the unit, and need no additional lubrication; to do so may actually damage the compressor. The air that is delivered by this type of Hookah compressor is pure, oil free air. It is how-

ever recommended that at least a 40 micron filter be included to remove any solid particles that may occur. This type of Hookah compressor contains sealed bearings rather than oil for lubrication which can contaminate the air supply. Most compressors utilize an "oil bath" lubrication system which will contaminate the air supply.

Hookah compressors operate at a relatively low pressure. The maximum pressure available from the higher capacity models is about 125 pounds per square inch. The higher the operating pressure, the lower the air output. Consistently high operating pressures (unless the unit is specifically designed for high pressure use) will shorten the life of the compressor by a noticeable degree. Conversely, the LOWER the operating pressure, the greater the air output and the longer the compressor life. A compressor should not be operated at high pressures unless a diver intends to be submerged at greater depths. If a diver is working at depths of 33 feet or less, he will need only 30 pounds per square inch for optimum operation of his regulator.

Most Hookah compressors have a built in "pressure relief valve" which prevents excessive pressure from building up in the compressor head when the diver is only making a small "demand" on the compressor. This valve is usually preset at the factory at approximately 50 p.s.i., which will give the average diver at shallow depths enough air to operate his regulator while leaving enough pressure left over

allow for increased exertion.

If a diver is breathing at a normal rate (light exertion), the pressure relief valve will occasionally "pop off" and shoot out a burst of air. This is normal, as it prevents excess buildup of pressure in the compressor head. If a diver is breathing heavily and is under physical exertion, he will be demanding all of the volume and pressure that the compressor can deliver. In this case, the pressure relief valve will rarely, if ever, discharge excess pressure or "pop off."

The type of Hookah compressor that is required for a given diving operation is dependent upon the extent of underwater physical exertion, the depth, and the number of divers that are connected to the system. A single diver under light exertion at shallow depths will require a relatively small air output that is measured in "cubic feet per minute," or "CFM". The same diver under heavy exertion will require additional air at a slightly higher pressure and volume.

If more than one diver is connected to an air system, or if diving at greater than normal depths, more air volume at higher pressures may be required.

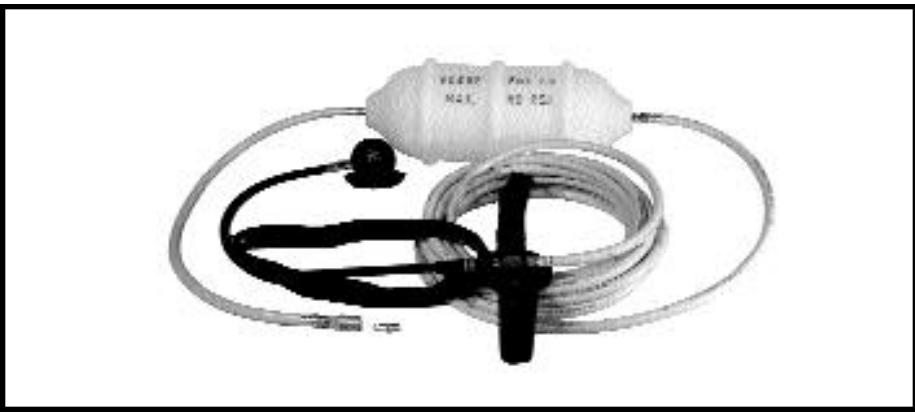
THE AIR RESERVE TANK

The next major component in the Hookah air system is the reserve tank. This very important piece of equipment performs four vital functions:

The reserve tank operates as an air "reservoir," that supplies a constant volume of air at all times. If, you are diving under heavy exertion and demanding a



Air Reserve Tank Model RT-1



Typical air system for one diver, including air hose, reserve tank, regulator, harness, and connector hose to compressor

greater amount of air, the large volume of air in the reserve tank will supply the reserve air required. If you were breathing directly from compressor itself, your rate of inhalation might actually surpass the air volume provided by the compressor, and you would not get a sufficient amount of air.

The reserve tank functions as a cooling and condensation vessel. Few divers realize it, but the air emerging from a Hookah compressor is quite hot, and can actually reach temperatures as high as 190 degrees.

As the air enters the the reserve tank, it will expand and cool. This expansion process will also condense most of the water contained in the compressed air. Hookah compressors, because of their small size, do not have capability to remove the moisture from the air and hence, they deliver air with an appreciable moisture content. The expansion process in the reserve tank allows the water to condense, ensuring that the diver breaths less moisture in the air.

The reserve tank also suppresses surges from the compressor or any temporary decrease in running speed. Often a the compressor's engine will run uneven due to moisture in the gasoline. The reserve tank can compensate for this by delivering

an even flow of air.

And finally, the most important function of all. The reserve tank will contain enough pressurized air to give the diver a couple of minutes breathing time, should his compressor, or engine failure run out of fuel. Equipment breakdown is not a pleasant thing to consider while working underwater, but is always a possibility. In the event of an engine failure without a reserve tank in the system, a diver could experience immediate loss of air that could lead to desperation and panic. Any experienced diver will tell you, that panic is the leading cause of drowning incidents.

THE AIR HOSE

The next component in the Hookah air system is the air hose. Hookah air hose is made of a special vinyl plastic construction, is resistant to the effects of oil, gasoline and sunlight that exists in the environment.

Conventional rubber hose should never be used for diving, because it will gradually deteriorate and become toxic. Hookah hose commonly has an inside diameter of 3/8ths. of an inch. It is constructed of an inner liner of

food grade vinyl wrapped with a

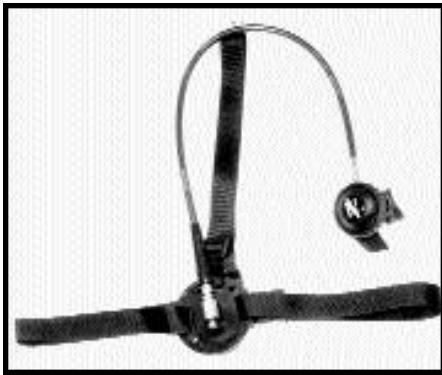
nylon webbing reinforcement and covered with a heavy duty PVC abrasion resistant wall. Hookah hose is designed to prevent kinking and collapsing that could prevent the flow of air being shut off

A quality Hookah hose will be colored a bright yellow or orange, for a high degree of visibility. It will also float, so that any excess hose not actually being used will float on the surface, completely away from the diver, reducing the possibility of entanglements on the bottom. For example, if you are diving in ten feet of water but using a thirty foot length of air hose, the excess twenty feet will float on the surface, completely away from you.

A quality Hookah air will not impart any "flavoring" to the air, and should meet "FDA and OSHA" requirements.

THE REGULATOR

The regulator is an oral respiration device that is worn in the divers mouth. The regulator regulates the amount of air that is received by the diver each time he inhales. Because the divers nose is covered by his face mask, air must be inhaled through the



Typical Hookah Air Regulator and Harness Model HR-2

divers mouth .

There are two types of diving regulators, those designed for SCUBA use and those designed for Hookah applications. A SCUBA regulator is designed for use with SCUBA a air tank, and delivers maximum efficiency when operated at a pressure exceeding 100 p.s.i. They require a "first stage" valve assembly, attached to the SCUBA tank. The function of first stage is to reduce the extremely high pressure of the air in the SCUBA tank from approximately 2,250 p.s.i. to approximately 180 p.s.i. This pressure then goes to the "second stage," which is the part that is worn in the diver's mouth. The second stage of a SCUBA regulator has a spring loaded "downstream" valve which delivers the correct amount of air to the diver when driven by an air pressure ranging from 100 to 250 p.s.i.

A prospective Hookah diver must realize that SCUBA regulators CANNOT be used for Hookah applications without special modifications. A typical Hookah compressor operates in an average pressure range of 30 to 50 p.s.i., which is not enough pressure to drive the spring loaded downstream valve of a SCUBA regulator. A diver who already owns

SCUBA regulator, but who wishes to use it for Hookah applications must take his regulator to a competent dive shop or repair station and get the regulator converted over for low pressure use; he should not attempt to do it himself. The conversion can be made by installing a set of low tension springs which will give maximum efficiency when operated at low Hookah pressures. A dive shop or repair station will also have necessary test gauges, etc., to make certain the adaptation has been effective.

A Hookah regulator is entirely different from a SCUBA regulator. It consists of a "second stage" only, which is fed directly from the output of the reserve tank via the air hose. There are valve assemblies of the type that are used with SCUBA tanks. Hookah regulators employ a "tilt," or "pin" valve, which delivers a full air flow to the diver at a pressure as low as 30 p.s.i. This type of regulator is specifically designed for use with low pressure Hookah compressors. Hookah regulators, as are all modern regulators, are of the single hose, "demand" type. A "demand" regulator works on a relatively low volume of air, since it only has to deliver air the diver breathes, or "demands" it..

THE HARNESS

A regulator should not be used for Hookah diving unless it is in conjunction with a "chest harness." The harness serves three principle functions:

1. It keeps the air hose from getting in the diver's way when he is working underwater. The harness has a "back plate" which is automatically positioned over the cen-

ter of the diver's back when the harness is worn. The back plate holds a "check valve," which acts as a "junction point" for the air hose and the regulator. Since the air hose terminates at the diver's back, it prevents potential entanglements around the diver's body.

2. The regulator intake hose that attaches to the check valve prevents any pulling motion from the regulator while working underwater. For example; if a diver were moving around underwater and inadvertently came to the end of the air hose, the harness would absorb the shock and the regulator and would not be jerked from the diver's mouth.

3. The check valve that is found on the back plate performs the third very vital function. It acts as a "safety gate" by shutting down the air system, allowing the air to travel in only in one direction. Should a burst or leak occur in the air line somewhere between the output of the compressor and the input of the check valve, it could prevent a vacuum occurring in the mouthpiece of the regulator or cause a diver to breath in a large amount of water that could cause panic. " Never, ever, dive without a harness and check valve!"

INCIDENTAL ACCESSORIES, HOSES, HINTS, PRECAUTIONS:

One accessory hose item you will need is a short length of hose for routing the air output from the compressor to the input of the reserve tank. The type of hose that is needed depends upon the compressor you are using. Diaphragm models that operate in the 30 to 50 p.s.i. range use a

simple hose connector that is made of hookah air hose. The high pressure, high volume piston compressors that are capable of delivering pressure of 100 p.s.i., require a connector made of special certified "heat resistant steam" hose, due to the fact that these models discharge air at higher temperatures.

When setting up a Hookah air system, you will frequently need an array of metal fittings. For use around water, you should use stainless steel or brass fittings only. This is especially important when diving in salt water.

Fittings made of ferrous metal will rust or corrode when used in, or near a water environment.

If your Hookah compressor is powered by a gasoline engine, make every effort to ensure that the engine exhaust (which contains deadly carbon monoxide gas), is always placed DOWN-WIND from the compressor. This will help prevent exhaust from being accidentally pulled into the compressor's air inlet. Always use a "snorkel" extension on any compressor that can elevate the intake of the air supply away from engine exhaust contaminants.

Never use a gasoline powered compressor in confined areas, such as underneath piers, in close, narrow grottos, etc. This will prevent the exhaust gases from dissipating into the atmosphere safely. Also, never dive in an area where there is little ventilation or air movement. Take special precautions when diving in areas where the air is extremely still, as dead air spaces, or poor ventilation can cause exhaust gases to linger in the immediate area of the engine

and compressor unit. Always install a long extension on the intake of your compressor to avoid the possibility of contamination of Carbon Monoxide Gas from the engine exhaust system. The air intake of a compressor must tower over the engine exhaust at a sufficient height and distance to avoid intake of engine exhaust gas. If this gas is inhaled even in small quantities for short periods, it can cause severe headaches and possibly result in sickness. In larger quantities it can kill you, so please be careful!

If you are using Hookah equipment around salt water, be sure to rinse off all your components with freshwater afterwards. This includes your regulator, diving mask, harness, metal fittings, and air hose (flush it out on the inside as well as outside). A salt water environment will quickly corrode aluminum parts such as: Hookah compressors and gasoline engines. It is advisable to keep all metal components freshly painted and cleaned to avoid excess corrosion.

If you are using a gasoline powered compressor always shut off the engine before attempting to refuel. Do not attempt to refill the engine's gas tank while the engine is still running, as this will increase the possibility of spilling gasoline onto a hot engine, which could result in a potential fire or cause an explosion.

A diver should always surface and shut off the engine first prior to refueling and allow time for the engine to cool down. Always use a funnel for refilling the gas tank or a special spillproof gas container to prevent spillage. Every Hookah diver should understand the basic rudiments of engine and compressor maintenance, and should always keep his equipment in top condition. If you take proper care of your equipment, it will give you many years of trouble free service. Knowledge how to work on your own equipment will also come in handy, should you experience any mechanical failure on a diving trip. It is a good idea to carry along some spare parts for your air compressor, and the necessary tools to make repairs.

All of the basic "rules of the deep" that apply to SCUBA diving also apply to Hookah diving as well.

UNDER NO CIRCUMSTANCES SHOULD YOU DIVE ALONE.!

Always Hookah dive with a partner who owns his own regulator, harness, and air hose. Make sure that his or her equipment as well as yours is attached to the air system at all times. If you were to experience underwater problems, your "diving partner" should be available to come to your immediate assistance.

Even though no formal instruction is required to use Hookah equipment, we strongly recommend that all divers should take a "CERTIFIED SCUBA" course at your local county or diving supply store.

You should also read books on the subject of underwater diving safety and study them thoroughly. This will further familiarize you with the "rules of the deep."

WARNING CARBON MONOXIDE GAS

If you're considering diving with a "Hookah Compressor" , It is most important that you become aware of Potential Danger associated with exhaust emissions. We place a caution label on the engine, warning of dangerous engine fumes and also illustrate further warning in " Introduction to Hookah Diving" and Safety in Gold Dredging that is issued with the purchase of all diving equipment.

WHAT IS CARBON MONOXIDE GAS?

Carbon Monoxide is an invisible odorless gas which gives no warning of its presence. It is the product of the incomplete burning of any material such as ; Oil Gasoline, Wood, Coal, etc. that contains carbon.

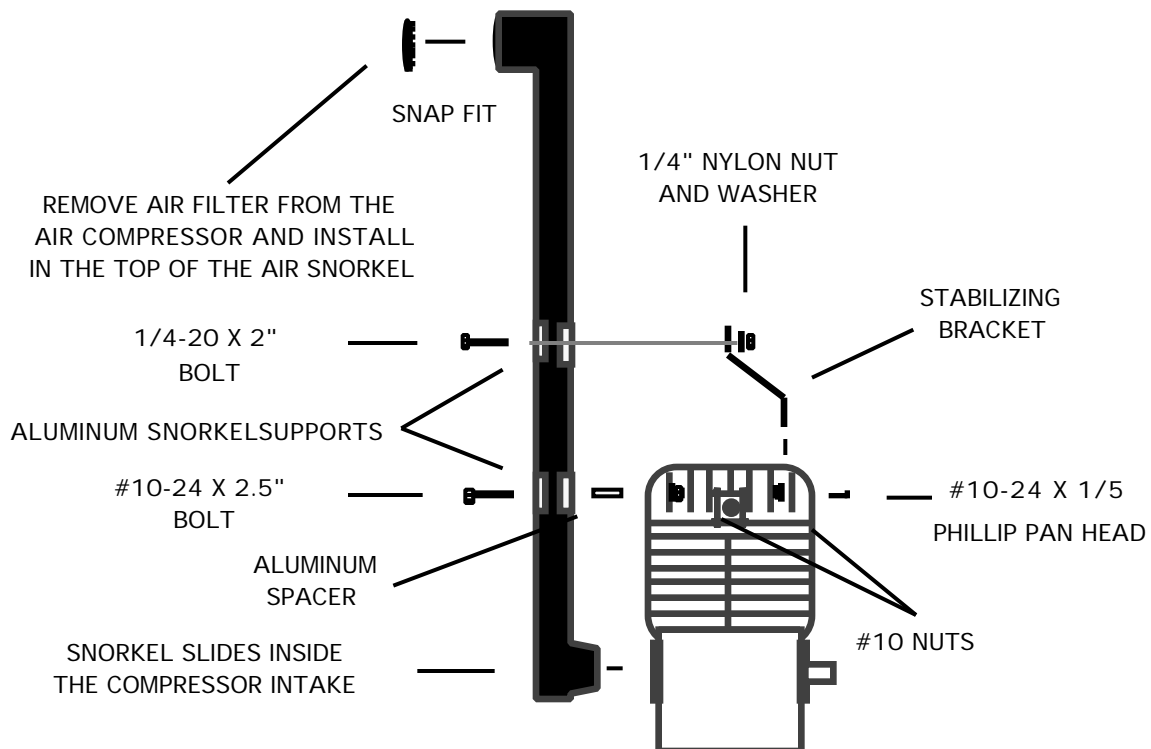
WHAT IS THE EFFECT OF CARBON MONOXIDE EXPOSURE?

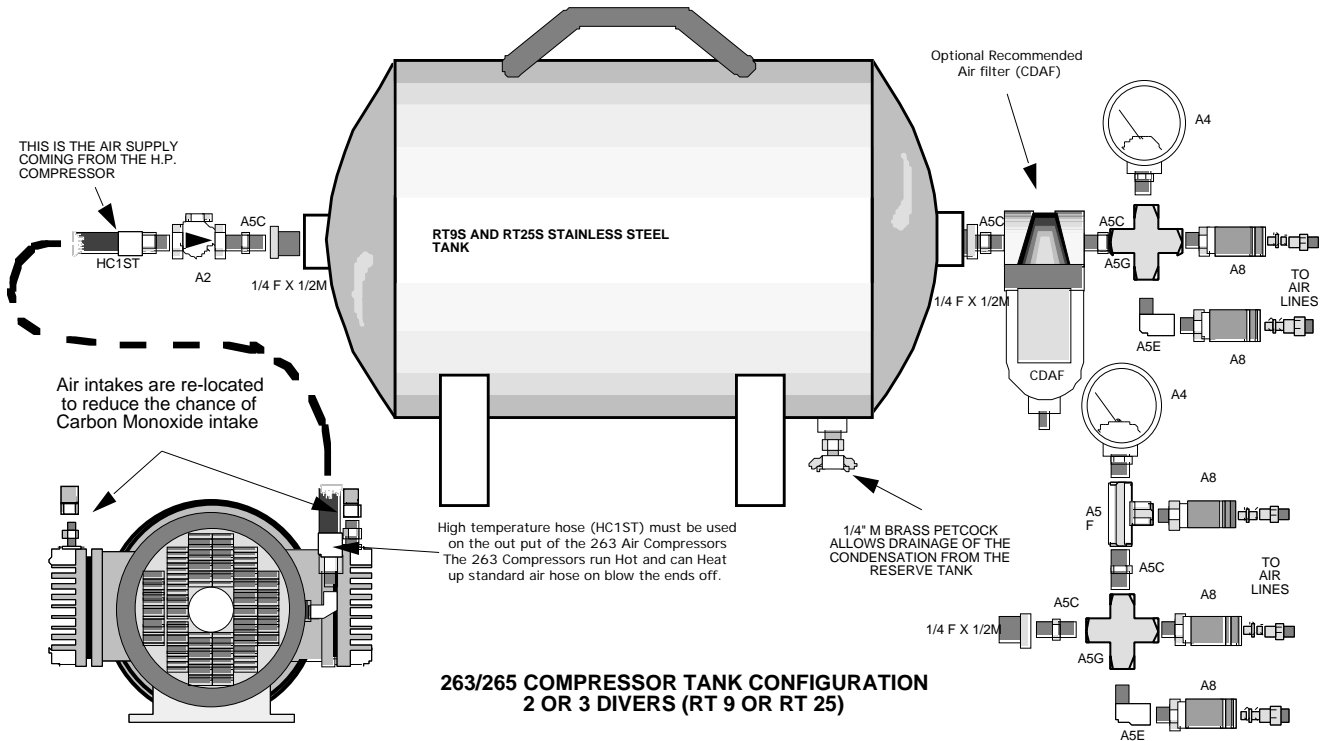
Carbon Monoxide deprives the blood of its ability to carry oxygen throughout; the body. When Carbon Monoxide is inhaled , it chemically combines with hemoglobin, the oxygen carrier in the blood. Even if there is plenty of oxygen in the air, hemoglobin combines much more readily with Carbon Monoxide than with oxygen. As the oxygen level of the blood is reduced, the heart must pump faster in an effort to supply sufficient amounts of oxygen to the brain and other parts of the body. When the brain does not receive enough oxygen, symptoms of headache, dizziness and mental confusion occur. Further exposure to the gas causes lack of coordination, weakness and nausea. The final effect of excessive exposure are convulsions, coma and death.

Needless to say, we cannot emphasize strongly enough that caution must be excersized. Never dive alone, never dive in an enclosed area, or in an area where good ventilation is not eminent such as; under piers, narrow grottos, under heavily overgrown brush or trees or in any area where a good breeze does not occur. Always make an effort to position your air unit to allow the prevailing breeze to carry any exhaust emissions away from the air intake of the compressor.

Remember, Carbon Monoxide is the product of incomplete burning of gasoline and oil, so it most important to keep your unit properly running and clean. Never allow gasoline to overfill or spill anywhere near engine and compressor.

THE SAFETY AIR SNORKEL DOES NOT ELIMINATE CARBON MONOXIDE GAS, IT ONLY AIDS IN THE REDUCTION OF FUMES. ALL THE SAFETY CAUTIONS MUST BE OBSERVED !





263G & 263GH

Remote air intakes reduce the chance of Carbon Monoxide Poisoning

