

BREATHING GEAR

In use in the Canadian Navy to-day there are four different types of breathing gear, Miner's Safety Appliance (M.S.A.), self contained set, A.N.S. Salvus self contained set, M.S.A. hose mask, and Patt. 230. All are properly equipped to be used on land while only one set, A.N.S. Salvus is transferable to a shallow diving unit.

M.S.A.:- An American type of breathing apparatus, originally designed for use in Mines and later adapted into the Canadian Navy for fire fighting. The set weighs 25 pounds and strapped on the man's back. May be worn in any kind of a concentration of smoke and also in any gas that is not harmful to your skin itself. On the bottom of the set is a bottle of oxygen charged to 2,000 lbs pressure containing 6 cubic feet of oxygen. If doing light to normal work the supply of oxygen will last for 1 hour but if heavy work is done the supply will only last approximately 40 to 50 minutes, according to the type and duration of work to be done. On the back is a heavy heat-treated rubber breathing bag which stores up reserve oxygen and purified air before it is inhaled into face-piece. Attached to the breathing bag is a small metal disc called the Bumper Plate. Behind the Breathing Bag is a Metal canister called the Re-generating Unit. This canister is filled with any one of the three kinds of impregnated Lime, Protosorb, Safetysorb or Carboxide. As exhalation takes place, these chemicals filter out all Carbon Dioxide and Nitrogen from the breath. The foul ingredients are kept inside the chemicals while the pure air is brought back to the breathing bag. Every time exhalation takes place twenty per cent of the air (foul ingredients) are taken out while only 80% reaches the breathing bag. This is where the oxygen bottle comes in, it replenishes the 20% that is taken out. If this set were worn without the use of a Breathing Bag and re-generating Unit, and exhalation breath was discharged to atmosphere, the supply of air would only last approximately 25 minutes.

Attached to this set are three small valves all in line with one another. Two are attached to this bottle and one to the set itself. The centre valve is the main supply. This valve may be easily identified in smoke or darkness as it is the centre one of the three and also has a small locking device on the side. When sending a man into a damaged compartment this valve should be locked open with a key and chain attachment supplied next to it. As this valve is opened up the air supply is opened up and allowed to flow through the main line up to the Reducing Valve. Here the pressure is cut down to about $2\frac{1}{2}$ to 3 pounds per square inch. It now flows through a small line through the re-generating unit up to the underneath side of the Breathing Bag directly behind the Bumper Plate. At the end of this line is a small plunger. It is kept on its seat, closing off the air supply with the air pressure behind. After the set has been strapped to the wearer's back and the main supply valve opened wide put on his face piece. As air is drawn from the Breathing Bag, as soon as the wearer inhales it will collapse, the Bumper Plate goes inward striking the small plunger taking it off its seat, allowing the air to flow from the bottle, through the reducing valve into the Breathing Bag. As soon as this bag has been sufficiently inflated it expands outwards, allowing the Bumper Plate to come off the plunger which again reseats itself cutting off the air supply. This makes the set all automatic. There is no danger of having the Breathing Bag being filled with air and splitting at the sides. On top of the Reducing Valve is a spring loaded relief valve which is set at $3\frac{1}{2}$ to 4 pounds pressure, or whatever pressure may be desired. So that if any thing should go wrong and the air is allowed to flow continuously from bottle, as soon as the pressure in the Breathing Bag exceeds the $3\frac{1}{2}$ or 4 pounds, it will escape out through the Relief Valve. The top valve is to take an atmospheric reading on the gauge. A full bottle registers 135 atmospheres and as the pressure decreases so the needle works back to the zero mark. As these sets were originally designed for use in mines, the gauge is carried on the wearer's right shoulder. To take a reading, first the Main Supply Valve must be open. Then open top Valve and take atmospheric reading and close valve off again.

In many cases the gauge lines become defected and leak. This doesn't hinder the working of the set for as long as Top valve is kept closed no oxygen is wasted and a fairly accurate reading may be taken if necessary. In darkness or smoke visibility is cut down to a very few inches and in dense smoke visibility is nil. Therefore, the clock itself will not be visible. As a man always allows himself ten minutes to come out of a compartment the M.S.A. set is rigged up with a warning whistle which will blow automatically when the air supply in the bottle has decreased to 95 atmospheres (approximately 12 minutes left inside). However, this warning device does not always prove successful so, before sending a man inside the compartment, a life line of light cable or wire should be attached around the wearer's waist. When his time is up inside the compartment a tug on the line will inform him to come out.

The bottom valve on the set is for emergency purpose only. If a man should be wearing the set with knowledge that there is sufficient air in the bottle and yet finds it possible to inhale the small plunger on the air line leading to the breathing bag is probably stuck on its seat. It is then that this bottom valve is opened allowing the air to pass straight from the bottle through a small line, through a pin-hole sized orifice into the breathing bag. Any excess air will of course be allowed to escape through the relief valve. The emergency valve is to be left open until the wearer is safely out in the open air.

The two breathing tubes are connected at the top end to a "T" tube on the bottom of the face-piece. At each end is a check valve, so that on inhalation, check valve on exhalation side closes, and vice-versa. On the bottom of the "T" tube is a saliva relief gland. After wearing the set for any length of time sweat and saliva collects in the bottom of the face-piece. By pushing up on the button the moisture may be blown out through this gland. Care must be taken not to allow smoke or gas to be drawn into the face-piece, and lungs. After the face-piece is secured into place and straps tightened, the inhalation tube should squeeze tight and the wearer try to inhale. If air is drawn in through one side of face-piece, that side is tightened up a little more.

The chemicals in the re-generating unit are good for an hours use. After that time the old charge is drained out and a fresh charge put in. The set must be recharged after each time it has been used whether for five minutes on a demonstration test or on actual working conditions. As soon as one exhalation breath passes through the chemicals, a chemical action takes place and continues to do until completely run down. A protection plate fits over the Breathing Bag to protect against any sharp obstructions. This set is not equipped for underwater use.

THE R.N. TYPE SALVUS BREATHING GEAR.

This is also a one (1) hour self contained set for use in gas and smoke, and is also transferable for under water use. The set weighs 14½ pounds and is carried on the left hand side, slightly to the front. The breathing bag comes in the shape of a heavy rubber lung. The oxygen bottle contains one hour supply compressed at 1800 Lbs. The re-generating canister contains chemicals as in the M.S.A. Set. To this canister the bottom ends of the face-piece and breathing bag tubes are connected. The face-piece tube at the bottom connects to a "T" tube, which extends to within ½" from bottom of canister while the breathing bag tube is connected to the top of the canister. A reducing valve is set on the main line to cut the pressure down to a steady flow of two litres per minute. This is sufficient along with the exhalation breath being regenerated to keep a man going while doing light to normal work. There are two valves attached, the "Main Supply" being situated on top of the bottle and the "By Pass" situated on the main line between the bottle and reducing valve. Attached to the Main line also is a clock attachment which registers 60 minutes on a fully charged bottle and works back to 0 as the pressure decreases.

To put the set into operation the Main Supply is opened wide and face-piece strapped into place. Air is released from the bottle through the Main Line into the reducing valve where it is cut down to the steady flow of two litres, into the "T" tube.

If inhalation is taking place air is drawn from the breathing bag through chemicals in canister to the bottom up through the "T" tube, taking with it the steady flow from oxygen bottle and on up the tube into the face-piece. On exhalation the operation is just the opposite. The steady flow of oxygen from the reducing valve is sufficient to replenish the amount of air taken from the exhalation breath in re-generating canister when the wearer is doing light to normal work. As soon as heavier work is attempted breathing naturally comes faster. This is when the steady flow is not enough to replenish oxygen for the Carbon-dioxide taken out in the regenerating canister. This will be noticed by the breathing bag becoming flat, therefore, inhalation will be laborous. To overcome this, open and close "By Pass" valve which allows oxygen to flow from main line into a smaller line by passing reducing valve into "T" tube and on into breathing bag, replenishing the supply.

Should there be too much air in breathing bag, exhalation will become difficult. On the bottom of canister is a spring loaded relief valve. Press up on this and exhale, and repeat two or three times. This allow the exhalation breath to be blown straight through the set and out the bottom. NEVER inhale while relief valve is held open.

There is also an asbestos hood and cape supplied, the hood to fit over wearers' head and cape around breathing bag to protect against sparks. The charge in regenerating canister is the same as in the M.S.A. Set. After each time the set is used, face-piece and breathing bag tubes should be washed out with soap and water and hung up to dry.

This Set may also be used below water. The proper facilities are supplied. A lead plate counter-weight is carried on right side, weighted shoes are worn to keep the wearer upright. The crutch strap on breathing bag is fastened to keep breathing bag from floating up. A mouth-piece replaces the face-piece, which is inserted passing elastic band over the head. Put on nose clips and goggles which are treated for underwater use. On waist belt is a pouch with two brass plugs. The gauge line and gauge are disengaged from main line and one plug screwed in. The other plug is used in place of spring-loaded relief valve as an automatic relief valve is fitted on breathing bag, and works effectively below water. A life line is used to lower or raise man in water and another line for signals.

The apparatus may be used in a depth of 30 to 35 feet for a period of 40 minutes.

The two sets which are not self contained are :-

- 1) M.S.A. hose mask, is a heavy length of breathing line 20 feet, covered with asbestos. On one end is face piece, on other is a wire mesh filter. On inhalation air is drawn through filter, through breathing line, and into the face-piece. On exhalation it is discharged through nose pad in front. The hose is strapped to the wearer's waist. The line is so constructed that it will not kink up. An attendant looks after the breathing line and keeps filter in the open air. If one length is not long enough two or three additional lengths may be added.
- 2) Patt. 230, an R.N. type which works in exactly the same way as M.S.A. hose mask. The only difference is the hose is somewhat smaller and exhalation breath is discharged through a nose diaphragm in the face-piece. These two sets are to be used for gas and smoke, they are not designed for under water use.