ARE YOU READY FOR A NEW UNDERWATER WORLD?

TIR the new **UNDERWATER BREATHING APPARATUS WITH PARTIAL RECYCLING OF EXHALED GAS** with a tank of only 4,5 lt./0.16 cu. ft. (Nitrox - Heliox) allows an autonomy of about 60 minuts at 30 mt./100 ft. of depth, or 40 minuts at 40 mt./133 ft., still saving 50 bars in the tank in case of unexpected events.

At 30 mt. of depth it releases only 8 lt. per minute into the environment versus the over 80 lt. of a traditional open circuit, for this reason it is silent and does not disturb.

It is conceived for professional dives down to 140 meters of depth without electronics, or in its simplified version for recreational use down to 30 or 40 meters of depth safely.

It was ideated and made extremely simple to warrant the maximum of reliability and safety at any depth.

These are some of the features that distinguish it from the rest of the world production and make it unique:
- Breathing on offer like a motorcyclist riding at speed open-mouthed, so that breathlessness due to the overexertion can be excluded;

- a transparent canister allows to see condition of filtering material and it discharges outside possible liquid accumulated during the dive;
- it can work as a normal open circuit,
- replacement of the filter needs only a few seconds,
- cleaning of underwater breathing apparatus needs just a few minutes and does not need tools.

SPACE 40

T.I.R.
Tecnology Innovation Rebreathing
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Recreational underwater diving represents a manner of aggregation and, once in water, deserves great emotions but, to live such intense moments, the diver has to face up not little uneasiness, but being able to remove two of the main negative factors, diving could reserve very unforgettable moments.

A simple analysis put into evidence that by drastically reducing weight and overall dimensions of tanks and, during the dive, drastically removing or reducing the typical bubble noise of underwater breathing on open circuit, we would be able to enjoy the dive and appreciate the environment without inconvenience.

Thanks to underwater breathing apparatus with partial recycling of exhaled gas (SCR) semiclosed circuit **T.I.R./SPACE 40** (**T**ecnology **I**nnovation **R**ebreathing) we have reached the target; for instance, with a tank of only 4,5 lt./0.16 cu. ft. weighting about 5 kg./11 pounds, it is possible to make a dive of more than 60 minuts at a depth of 30 mt./100 ft., even keeping 50 bars on the tank for unexpected events; the logic consequence is a reduction of bubbles (more then 90%) compared to a traditional open circuit. In short, if at depth of 30 mt./100 ft. while using an open circuit about 80 lt./2.83 cu.ft. are exhaled every minute, with our underwater breathing apparatus these are reduced to about 8 lt./0.28 cu.ft every minute; this way the underwater environment is not affected by the "intrusions" and so it is not "frightened", certainly a goal that could be considered fantastic.

With that in mind it is appropriate to know into details the genesis of our underwater breathing apparatus with partial recycling of exhaled gas, which was wanted, planned and developed by Claudio Beux, a professional diver who dived for more than thirty years, usually down to more than 100 mt./334 ft.; being in difficulty due to very heavy open circuit equipmets and even more with semiclosed (SCR) or close (CCR) circuit breathing apparatuses available, he had to invent for himself a lighter underwater breathing apparatus that could help a less tiring respiration, allowing him to dive deeper than 100 mt./334 ft. without getting breathless while swimming against sea current.

From 1992 to 2004 twelve years of tests occurred, through which Claudio Beux made dozens of craftmade prototypes with several modifications (see photo); after over a thousand dives down to 140 mt./ 468 ft. of depth with no accident, he decided to put on market the underwater breathing apparatus TIR/ SPACE 40.

After most important and innovatory ideas had been patented in Europe, USA and Canada, a company started the manufacturing of several moulds necessary for the large production of the various components. It was undoubtely a heavy financial investment, targeted to obtain a more competitive product in comparison to current underwater breathing apparatus on the market having the same aims and final employment destination.

From 2005 Claudio Beux has had the chance to use and perfectionate all the prototypes obtained by mass production up to the final current version, which was already used in several hundred dives, all of them done at more than 100 mt./334 ft of depth.

Successively, the producer had the chance to carry out a simpler recreational version called SPACE 40, with the help of several instructors who did hundreds dives down to 40 mt./133 ft. of depth and did not find any major problem; so the decision was taken to start mass production.

The obtained outcome seems even too easy to use and, like many of the most brilliant ideas, it is the best you can find on the market in terms of safety, lightness, simplicity, functionality and cost.

To list its strenght points, the SPACE 40 is:
- **The safest**. A transparent canister allows to see if the filtered material is in perfect conditions and if there are liquids into it; in this case, with a very simple operation, it is possible to eliminate them outside even during the dive.
- **The lightest**. The standard version has a total weight of only 8 kg./ 18 pounds (filter and jacket included), while the version with a tank of 4,5 lt./0.16 cu. ft weights only 13 kg./29 pounds.
- **The simplest**. In just a few seconds it is possible to replace the filter; in just a few seconds it can be washed inside without dismantling it or using special tools; in case of emergency it can be used as a traditional open circuit. It is completely automatic and, in case of need, the automatic supply can be activated simply with the deep pressing of the central membrane in the counterlung like a big second stage.

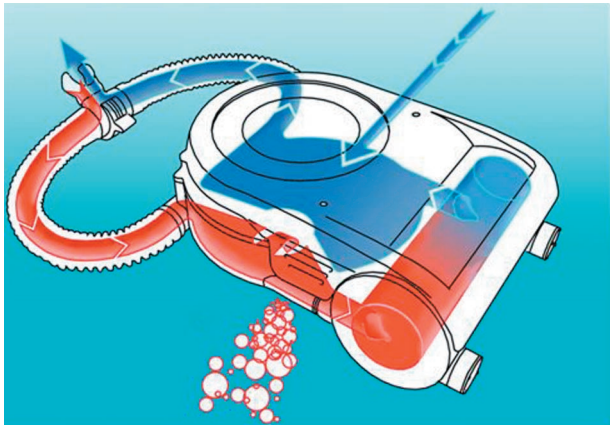
- **The most useful**, with its front position at same level with lungs center of gravity, the inhalation is supported by natural gas pushing up; therefore, during swimming phase, gas supply will be no more "on request" as for a traditional rebreather or an open circuit underwater breathing apparatus, but it will be "on offer" and sometimes it could resemble the same pleasant sensation experienced while riding a motorcycle at speed of 50 km./62 miles per hour and breathing open-mouthed.
- **The most competitive**. The use of injection moulds for the manufacturing in mass production has made possible a remarkable cost reduction, as well as the use of special materials like strengthened technical polymers and special elastomers, all of them oxygen compatible, light and very resistant. It is a product strictly and completely **MADE in ITALY**

In short, ***THE SIMPLEST AND SAFEST UNDERWATER BREATHING APPARATUS SYSTEM TODAY ON THE MARKET WORLDWIDE, WITHOUT EQUIVALENT ALTERNATIVES.***

SEMI-CLOSED CIRCUIT FOR RECREATIONAL USE

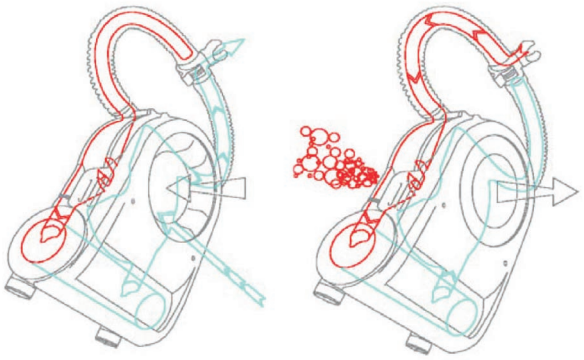
NOTE:It is for sport or recreational use when it is restricted to the maximum depth of 40 meters/133 feet and the diving time do not necessitate decompression stops. In any case, before the use of breathing apparatus, it is necessary to follow a specific course taken by qualified instructors.

The action of underwater breathing apparatus TIR/SPACE 40 is undoubtedly different from any other rebreather present on the worldwide market, as it has no internal bags and it does not exhale through an overpressure valve but, like others, it partially recycles exhaled gas.
Exhaled gas flux is leaded into a sealed loop that forces it to pass through the filter; the filter absorbs carbon dioxide produced by the organism during breathing, then it is reintroduced into the counterlung and is breathed again.



In order to allow these phases it is essential to enrich the used gas with oxygen to make it possible to be breathed additional times. The enrichment is provided by a constant flow added to exhaled gas after this one is cleaned by the filter; to make this possible only and exclusively breathable mixes as Heliox (Oxygen-Helium) or Nitrox can be used, according to the depth reached; common air cannot absolutely be used.

As we said, the channeled route of breathed and exhaled gas is sealed; through a red wrinkled hose it enters in a section that contains the exhaust valve linked to the counterlung big membrane by a thin tube and it arrives to the big counterlung that lifts the exaust valve membrane operating the opening during the phase of maximum expansion; this way the last part of the exhaled gas –containing the maximum carbon dioxide concentration- is vented outside; the exhaled gas staying in the loop enters the see-through container and then it goes into the filter, where the filtering material chemically removes carbon dioxide. The flux of cleaned gas goes into the counterlung and joins the continuous flow of mixture enriched with oxygen that arrives from the tank through the injector and through the black wrinkled hose, it is breathed in again and again for several times.



An agreeable collateral effect of these subsequent cycles is the progressive rise in temperature of the breathed gas that will not make the diver notice water temperature, even when it is cold.

Physicians claim that a diver's oxygen consumption can be an average of 1,5 lt. per minute (1 lt. at rest and 2 lt. under pressure) and that the oxygen partial pressure, resulting from the relation between the percentage of oxygen in the breathable mixture and the ambient pressure, must be less than 1.4/ maximum1.5 bars; so the percentage of oxygen present in the breathed gas and the quantity of constant flux (liters per minute) must be determined in advance according to the planned maximum depth of the dive. In short, the greater the depth of the dive will be, the greater will be the ambient pressure and consequently the smaller must be the percentage of oxygen present in the breathed gas; in our case the considered values are as follow:

maximum depth 22 mt./ 73 ft. = 50% oxygen = flux 6/6,5 liters/minute (on request)
maximum depth 30 mt./100 ft. = 40% oxygen = flux 9/9,5 liters/minute (standard)
maximum depth 40 mt./133 ft. = 32% oxygen = flux 14/14,5 liters/minute (on request)

As an example:in the case of 30 mt./100 ft. of depth, with a mixture having the 40% of breathable oxygen, the partial pressure will be: 0,40 (oxygen quantity) x 4ATA (ambient pressure) = 1.;, that is the largest and the most critical value if breathed on open circuit, correct and normal if breathed with a rebreather as it has not to be forgotten that after a few breathings the percentage of oxygen in the counterlung can be even reduced of about 5% and this has to be considered also for the dive time calculation.

To obtain the above values, underwater breathing apparatus TIR/SPACE 40 has a sealed pressure reducer that reduces the tank pressure from 200 bars to steady 13 bars (as a rule, in case of a sonic nozzle the intermediate pressure has to be at least double of foreseen pressure at maximum depth + 20%); in our case the gas originated from the tank, at intermediate pressure of 13 bars, passes through a sonic titanium nozzle with a calibrated opening that fixes a constant flow of 9 lt./ (with the 40% of oxygen for the 30 mt./100ft.) or 14 lt (with the 32% of oxygen for the 40 mt./133 ft.). In case of underwater breathing apparatus for professional use these parametres will be very different but, in any case, the flow of the mixture will always assure a suitable and more than adequate replacement of oxyigen at any depth.

The reference tecnical standards related to the CE (European Standard) require a breathing volume of 3 liters for closed circuits (EN14143) or of 2,5 liters for regulators in open circuit (EN250 and/or EN13949). Underwater breathing apparatus TIR/SPACE, the only one of its kind in the world, has no internal bags like all the other rebreathers on the market, but it has a counterlung with a membrane, which has a 2,5 liters volume and is more than sufficient to satisfy a normal breathing; if one or more very deep breaths are necessary, for instance in case of breathlessness due to fatigue, a demand larger than 2,5 liters will be fulfilled by the existing supply mechanics in the counterlung that will automatically deliver the needed quantity of fresh mixture enriched with oxygen without limitation and without effort, so that the diver will overcome immediately a possible critical situation; likewise, the diver will be able to do the cleaning of the counterlung, whenever they think it necessary, by simply exhaling from the nose or pushing on the center of the membrane. It is obvious that in all these circumstances the supply mechanics operation will cause a larger consumption and will penalize the foreseen endurance.

SEMICLOSED CIRCUIT FOR PROFESSIONAL USE

NOTE: we consider it for professional use when it is used under 40 mt./133 ft. and/or when dives with decompression stops are planned at any depth.

This kind of diving needs wider and more complete knowledge and professionality, even using Heliox mix too. Therefore it is not part of this informative report and of the normal use of underwater breathing apparatus TIR/SPACE 40 configurated for recreational use as explained later.

For information we specify that the professional version keeps unchanged the counterlung body and the technical features before indicated, while automatic mix of gas (Helium-Oxygen or Helium-Nitrox) and fluxes are directly conditioned by water pressure – a system we have patented also in USA and Canada. In short, two tanks are used, one containing Oxygen (or Nitrox) and the other Helium, as well as two pressure reducers and two pertinent titanium sound nozzles that automatically regulate flux management according to depth. For example, during the immersion oxygen (or Nitrox) amount decreases and Helium (diluent) amount increases; on the contrary, during the ascent while depth lowers oxygen (or Nitrox) amount increases and Helium amount decreases; this way decompression is made possible breathing mixes enriched with oxygen. Furthermore, in the last 12 meters under the water line(or 20 mt. when Nitrox is used) the breathable mix is devoid of the diluent (Helium).

The user can choose the tank capacity (4-5-7-10 liters), not forgetting that a tank should be used in open circuit in case of emergency (bail out); the capacity of this one must assure the endurance, considering time of ascent with decompression stops to be complied in the worst conditions. Users of a professional model can order an optional accessory to apply on the wrinkled hose (black), to hold one or two cells of toxygen analyzers and the related partial pressure. (**see photo REB 5**)

CLOSED CIRCUIT FOR PROFESSIONAL/MILITARY USE
(advanced A.R.O. - *Oxygen underwater breathing apparatus*)

Note: this version has been appropriately studied and designed as closed circuit for professional/military use down to a maximum depth of 12 meters (ARO), then it would work as semiclosed circuit (SCR) if diving to greater depth is needed, but only with Helium/Oxygen mix.

Underwater breathing apparatus TIR configurated as advanced ARO is NON-MAGNETIC and NOISELESS, it is provided of two light alloy tanks with a capacity that can vary from 3 to 8,80 pints (200 bars), pressure reducers are in TITANIUM as well the sonic; filter endurance (120 minutes) can be doubled as necessary for operational needs.

Even if it keeps the same technical features of previous versions and the same automatism, this special version called advanced ARO is a closed circuit down to 12 meters of maximum depth, with possibility to descend to lower depth if necessary. In this case, it becomes a semiclosed circuit when diving over 10/12 meters of depth, then it gets back to closed circuit version (ARO) when on the way back to water line at a depth lower than 12 meters.

This configuration needs a specific training as use of pure oxygen is expected. So it is essential that the user has been correctly instructed on potential dangers resulting from an incorrect use of it, and for this reason we reserve to furnish more detailed and exhaustive information on this topic during the theoretical and practical course taken by Claudio Beux; the frequency of our course at the company site is compulsory and it will provide the necessary licence to use our product.

SPACE 40 PERFORMANCES

The charts reproduced below show the performances of our T.I.R./ SPACE 40 (complete with ExtendAir filter and Heliox 30% mix that can be used down to a maximum operational depth of 40 meters), in accordance with reference to technical rules, particularly chart A refers to EN 14143 rules as required for closed circuit rebreathers that necessitate a ventilation rate of 75 lpm; chart B refers to different rules regulating open cicuit regulators that necessitate a ventilation rate of 62,5 plm.

In chart A it is possible to see that the Space 40 stays into the limits required and indicated on the graphic, even at the depth of 42,3 meters;

In chart B it is possible to see that the Space 40 stays into the limits required and indicated on the graphic, even at the depth of 58,1 meters or more.

Even if it does not belong to the two categories cited by the EN rules because of an innovative underwater breathing apparatus with partial recycling of exhaled gas that has not yet been ruled, through the graphics it is possible to evict that the Space 40 performances exceed the required restrictive parameters for both closed and open circuits.

DEMAND REGULATOR PERFORMANCE

– ANSTI ——— CRESSI-SUB ——— ANSTI –

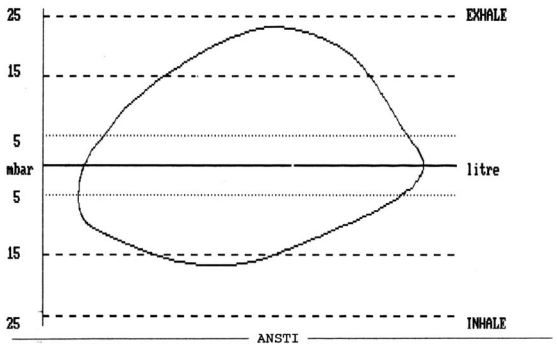
CERTIFICATE REFERENCE :
DATE : 06-02-2009 TIME : 11:29:38

EQUIPMENT
REGULATOR TYPE :
SERIAL NUMBER :
INTERSTAGE PRESSURE : 0.0/12.2 bar.g (SURFACE/DEPTH)

CONDITIONS OF TEST
ROOM TEMPERATURE : 20.0 C
WATER TEMPERATURE : 9.7 C
EXHALE TEMPERATURE : 16.0 C
HP SUPPLY PRESSURE : 300/121 bar.g (STATIC/DYNAMIC)
TIDAL VOLUME : 2.51 litre BREATH RATE : 30.09 bpm
VENTILATION RATE : 75.4 lpm

RESULTS
INHALE PRESSURE = 17.02 mbar (LIMIT = 25 mbar)
INHALE POS PRESSURE = 0.10 mbar (LIMIT = 5 mbar)
EXHALE PRESSURE = 23.42 mbar (LIMIT = 25 mbar)
EXT WORK OF BREATHING = 2.80 J/l (LIMIT = 3.0 Joules/litre)
INHALE WORK = 1.25 J/l
POS INHALE WORK = 0.00 J/l (LIMIT = 0.3 Joules/litre)
EXHALE WORK = 1.55 J/l

PRESSURE - VOLUME DIAGRAM AT DEPTH OF : 51.0 msw (167 fsw)



DEMAND REGULATOR PERFORMANCE

– ANSTI ——— CRESSI-SUB ——— ANSTI –

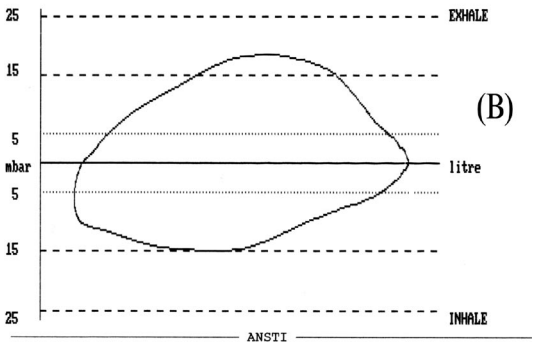
CERTIFICATE REFERENCE :
DATE : 06-02-2009 TIME : 11:31:09

EQUIPMENT
REGULATOR TYPE :
SERIAL NUMBER :
INTERSTAGE PRESSURE : 0.0/12.3 bar.g (SURFACE/DEPTH)

CONDITIONS OF TEST
ROOM TEMPERATURE : 20.0 C
WATER TEMPERATURE : 9.7 C
EXHALE TEMPERATURE : 15.6 C
HP SUPPLY PRESSURE : 300/ 93 bar.g (STATIC/DYNAMIC)
TIDAL VOLUME : 2.51 litre BREATH RATE : 25.07 bpm
VENTILATION RATE : 62.9 lpm

RESULTS
INHALE PRESSURE = 15.25 mbar (LIMIT = 25 mbar)
INHALE POS PRESSURE = 0.00 mbar (LIMIT = 5 mbar)
EXHALE PRESSURE = 18.79 mbar (LIMIT = 25 mbar)
EXT WORK OF BREATHING = 2.33 J/l (LIMIT = 3.0 Joules/litre)
INHALE WORK = 1.13 J/l
POS INHALE WORK = 0.00 J/l (LIMIT = 0.3 Joules/litre)
EXHALE WORK = 1.21 J/l

PRESSURE - VOLUME DIAGRAM AT DEPTH OF : 58.1 msw (191 fsw)



DEMAND REGULATOR PERFORMANCE

– ANSTI ——— CRESSI-SUB ——— ANSTI –

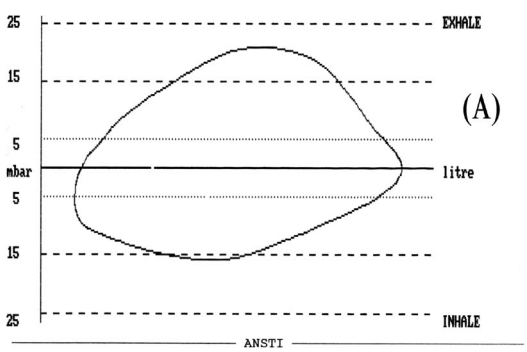
CERTIFICATE REFERENCE :
DATE : 06-02-2009 TIME : 11:28:36

EQUIPMENT T.I.R. / *SPACE 40* Heliox 30%
REGULATOR TYPE :
SERIAL NUMBER :
INTERSTAGE PRESSURE : 0.0/12.0 bar.g (SURFACE/DEPTH)

CONDITIONS OF TEST
ROOM TEMPERATURE : 20.0 C
WATER TEMPERATURE : 9.6 C
EXHALE TEMPERATURE : 16.0 C
HP SUPPLY PRESSURE : 300/142 bar.g (STATIC/DYNAMIC)
TIDAL VOLUME : 2.51 litre BREATH RATE : 30.14 bpm
VENTILATION RATE : 75.6 lpm

RESULTS
INHALE PRESSURE = 16.14 mbar (LIMIT = 25 mbar)
INHALE POS PRESSURE = 0.00 mbar (LIMIT = 5 mbar)
EXHALE PRESSURE = 21.15 mbar (LIMIT = 25 mbar)
EXT WORK OF BREATHING = 2.55 J/l (LIMIT = 3.0 Joules/litre)
INHALE WORK = 1.19 J/l
POS INHALE WORK = 0.00 J/l (LIMIT = 0.3 Joules/litre)
EXHALE WORK = 1.37 J/l

PRESSURE - VOLUME DIAGRAM AT DEPTH OF : 42.3 msw (139 fsw)



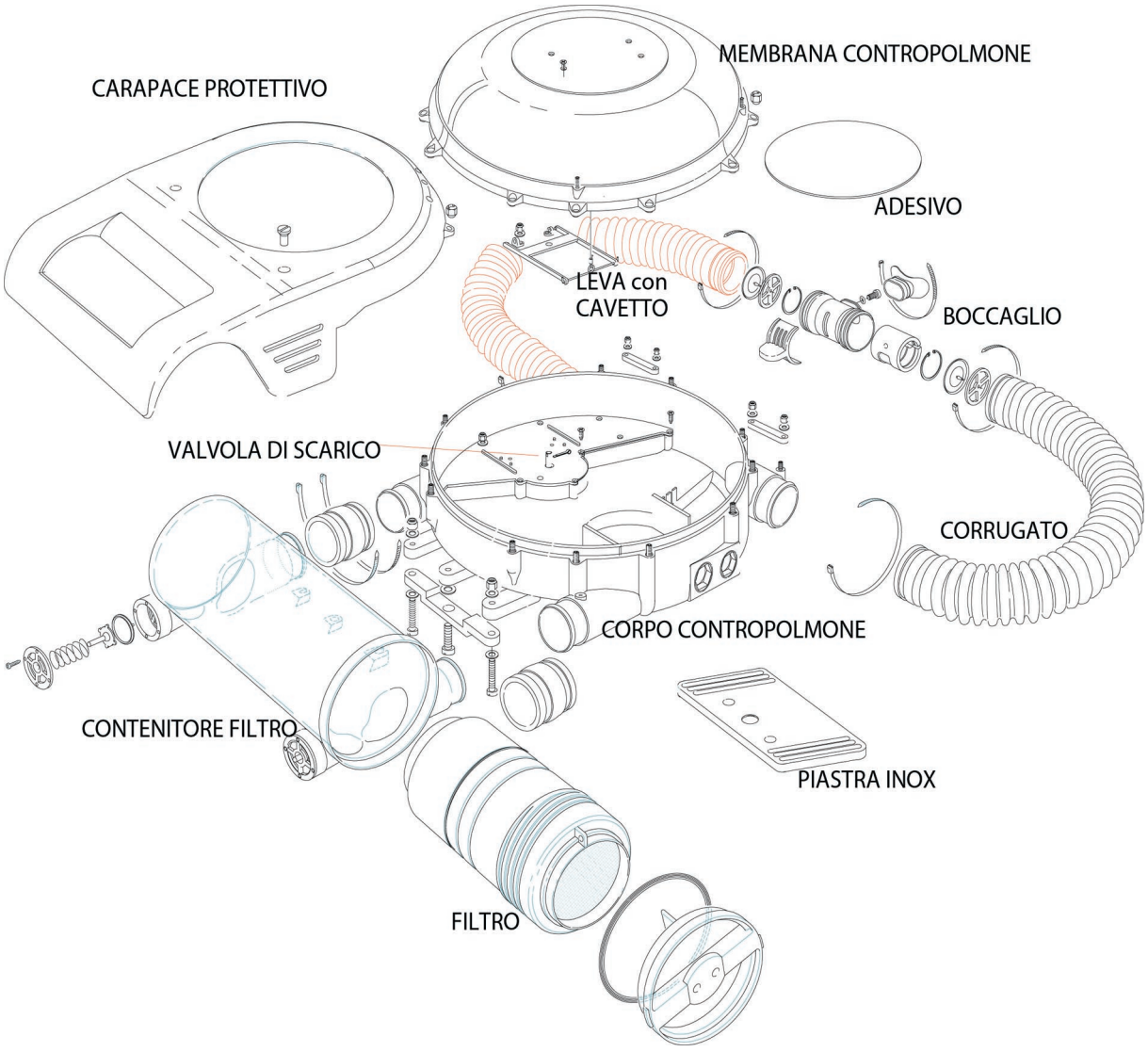
*We wish to thank the **CressiSub** for allowing the use of its facilities and its technical equipments freely in more than an occasion.*

USE OF RECREATIONAL UNDERWATER BREATHING APPARATUS

Underwater breathing apparatus TIR/SPACE is delivered with the following standard accessories:

1) An underwater breathing apparatus / counterlung;
2) A sealed pressure reducer;
3) Standard injector with TITANIUM sonic nozzle with measure indicators, providing flow of 9,5 lt. for 40% of oxygen (as optional for flow of 14/14,5 lt. for 32% of oxygen);
4) A complete Buoyancy Control Device with strengthened technopolimer backholder, or as optional in stainless steel;
5) A standard analogic underwater gauge, or the AIR LIMIT MONOMETER as optional;
6) A filter and its scrubber;
7) A set of straps to be used with a traditional BCD, or without it;
8) An user and maintenance guidebook;
9) A balanced alternate air source, Oxigen power-assisted model (as optional);
10) As optional, a 5 or 7lt. alluminium or steel tank, with twin valve Din 16 x 2 tube for Heliox/Nitrox.

A reference set of rules follows.



1) COUNTERLUNG

It is an essential component of underwater breathing apparatus made with a special stiffened technical polymer; inside it the following parts are positioned:
a) a by-pass, an automatic gas supply mechanism;
b) a constant flux connection;
c) an exaust valve with the lever integral with the membrane through a thin tube;
d) a counterlung membrane with relative inner and outer spaces;
e) a canister;
f) a mouthpiece with wrinkled hoses;
g) connections for the hoses coming from the pressure reducer;
h) quick connections for the buoyancy device in the underbelt;

Note: we suggest periodical washing and check up of internal parts, in order to verify that there are no signs of dirt, residuals of any kind, moulds or anything else that can pollute the clean flux crossing the counterlung at each breath; moreover check that the one-way mouthpiece valves are intact and clean.

2) PRESSURE REDUCER

The pressure reducer is sealed for major safety. A piston placed inside works while protected by two membranes and as it is not in contact with the external environment, it is not polluted; it is connected to the tank valves that have a Nitrox DIN 26x2 connection as required by current regulations (if necessary only on individual request also the DIN 25x2 or the reducing tube connection from 26x2 to 25x2 are available); it reduces tank pressure from 200/300 bars to 13/13,5 bars; it is furnished of 3 low pressure outlet 3/8 unf and 2 high pressure outlet 7/16 unf appropriately signed HP.

Note: we suggest periodical testing of intermediate pressure (13 bars) using a normal air gauge connected to the quick release hose of the Bouyancy Control Device (BCD).

3) SONIC NOZZLE INJECTOR

An intermediate constant 13,0 bars pressure, arriving from the pressure reducer, passes through a titanium injector (sonic nozzle) and allows a stable flux of 9/9,5 liters per minute when using Heliox or Nitrox 40% mix for the maximum depth of 30 mt., or of 14/14,5 liters for minute when using Heliox 32% mix for the maximum depth of 40 mt..
The injectors are externally marked by a notch that shows oxygen rate in the breathing mix, so that an injector marked **40** will have the titanium nozzle marked with a flux of **9/9,5 lt.** per minute for dives down to **30 mt./100 ft.** of depth; an injector marked **32** will have the titanium nozzle marked with a flux of **14/14,5 lt**. per minute for dives down to **40 mt./133 ft.** of depth.
The titanium nozzle is properly kept by an uninterrupted wire stainless steel type sintered filter; when appropriately used it is positioned inside the injector body.

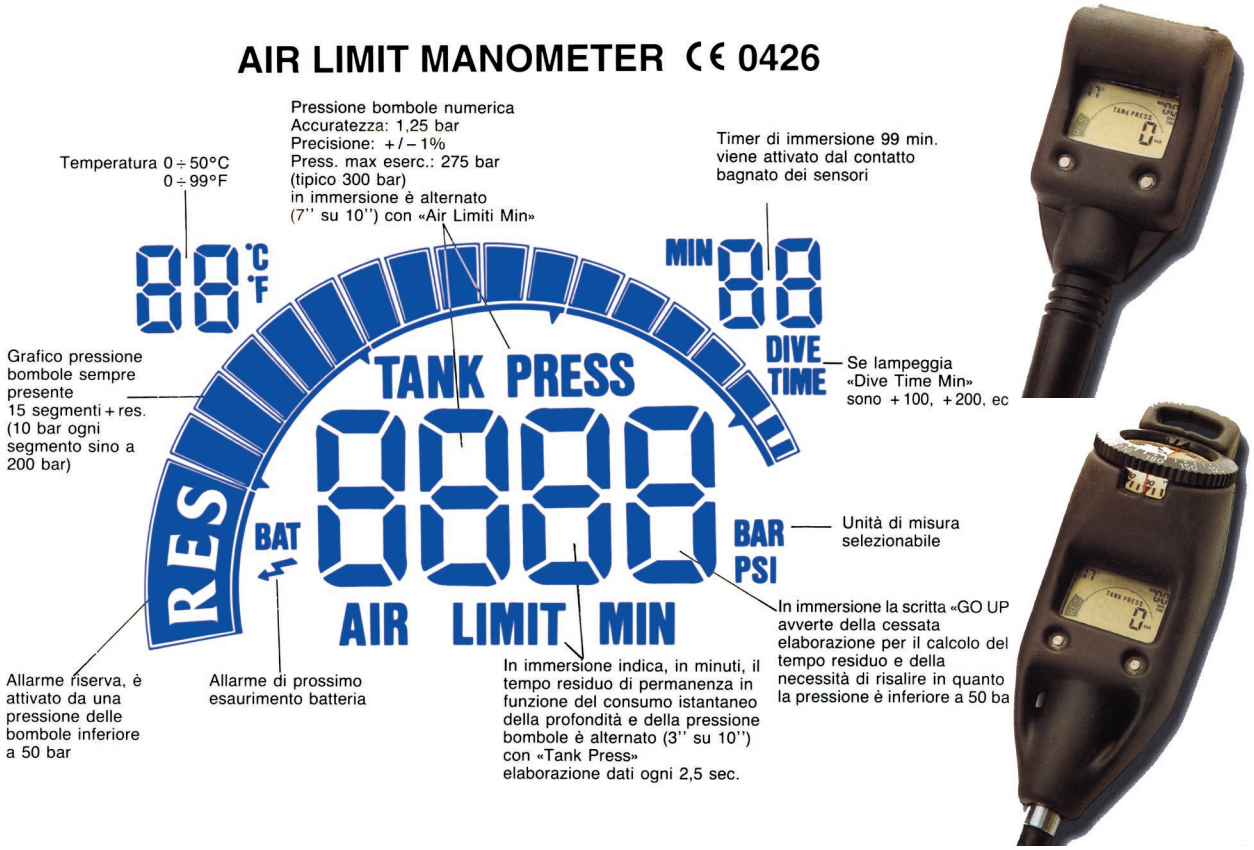
Note: at least once a year we suggest to check the sintered filter and proceed for a test of the flux through a fluxmeter (optional); if dirt can be detected, proceed immediately to the replacement of the filter, followed by a flux control.

4) BCD (Buoyancy Control Device)

The supplied Buoyancy Control Device is a single bag type made with processed materials like "ny-trevira" or "cordura 420/840 dn.", radiofrequency sealed; the buoyancy capacity is of about 18 kg. when used with backpack and related strengthened technical polymer plate; when it is used with backpack and stainless steel plate, the buoyancy capacity drops to about 16 kg..It is furnished with all the quick connections and two adjustments to properly apply and position the counterlung in a very simple way.
If necessary, it can be used also as a normal rear lift capacity type Buoyancy Control Device.
For those who travel an equipment is provided: a belt with quick release buckles and two adjustments that allow to wear underwater breathing apparatus as a traditional jacket (even when rented at local facilities).

5) THE PRESSURE GAUGE

It is an analogic standard gauge with high pressure hose; as an optional it is possible to get the AIR LIMIT MANOMETER: an electronic gauge that can elaborate the remaining diving time in relation to present consumption, tank immediate pressure, temperature, dive time, supply for ascent; it is also available with console and a compass. It is recommended when several accessories connected with the pressure reducer are used, as dry suite, buoyancy device, alternate air source, etc.



6) FILTER

Filter and filtering material are of main importance for the correct use of underwater breathing apparatus with recycling of exhaled gas, as in the case of wrong filtration process, very serious dangers can occur to the user. Therefore it is fundamental to keep the filter intact and perfectly working.

ExtendAir filter

Filtering material holds back carbon dioxide produced and present in exhaled gas; it is of the Sofnolime type (see handbook for the user) and if used inappropriately it can produce dust. In this case it is necessary to clean the canister. As an alternative choice an ExtendAir filter may be used, which is produced by Micropore in USA; both filtering materials have been tested for underwater use. Spherasorb filtering material, which is also used by several divers, has not received confirmations about its suitability for underwater use by the producer.
Both the Sofnolime filtering material contained in the equipped cartridge, weighting about 1,5 kg., and the ExtendAir filter allow an autonomy of about 120 minutes (this time must be respected), but we cannot exclude less duration due to a inproper storage; in any case the Sofnolime material that we supply comes with a chemical indicator which changes color from white to pink/violet (when exhausted) as the material absorbs CO2 and the filtering capacity decreases.

ATTENTION:it is absolutely necessary to replace the Sofnolime filter before colour changes; use of a filter no more able to withhold carbon dioxide is extremely dangerous.

The filtering cartridge made of transparent material is disposable but it can be reused if refilled by retailers or the user, or at a diving center. It is made up of plastic materials with a screwed plug and two stainless steel nets that keep filtering material tightly compressed; after refilling, the cartridge is usually put into an opaque white bag (not transparent) and it is packed into proper containers for comfortable transportation.
The filtering material has a limited duration time so the expiration date showed on the container must be always checked.

NOTE: Before use always check that the container is filled with filtering material and that there are no empty spaces; in this case it is necessary to change the filter with another full one. In case of doubt about the integrity of the cartridge and/or of its contents, postpone any dive and replace the cartridge.

CANISTER

Canister is linked to counterlung through three stainless steel screws and it is made of a special technical shock resistant polymer; it is completely transparent to let the user see the presence of water in it or verify the condition of the filtering material. One of its kind, it has a lateral air cavity between itself and the filter to isolate the filtering material from cold external temperatures, so that the chemical reaction blocking body-produced carbon dioxide

is made easier by the exhaled gas higher temperature; moreover, two exhaust valves, each one having a membrane, are provided to allow the emptying of the canister even during the dive. The canister plug with bayonet coupling is furnished with an o-ring washer that warrants a perfect sealing.
If the canister is not used for long periods, the plug could become hard to open and more effort would be necessary, but this is normal as it is due to a stronger o-ring friction.
Note:always verify the integrity and the clearness of the o-ring washer on the closing plug as it could show signs of filtering material dust. Also always check that the o-ring is correctly positioned.

7) USER AND MAINTENANCE GUIDEBOOK

Each underwater breathing apparatus is delivered with the present producer information guidebook and a warranty as well as an user and maintenance guidebook that should be carefully read by the user. The warranty must be filled in and sent to the producer for validation; the producer declares no responsibility in case the user does not respect instruction given in the forementioned guidebooks, or for the incorrect use and maintenance of the product and its parts.
The user and maintenance guidebook and the present information leaflet integrate but in no case substitute a proper diving course held by qualified trainers.

Note: in case your underwater breathing apparatus has been delivered without an user and maintenance guidebook, please request it before using our product.

8) INTEGRATED ALTERNATE SOURCE

The use of the underwater breathing apparatus TIR/ SPACE does not exclude the presence of an open circuit alternate air source, as it can be chosen by the user. It can be connected to the main pressure reducer or a traditional open circuit regulator connected to the second valve can be used.
In the first case, if the tank has a single connection, to connect to the main pressure reducer the second stage should be a balance power-assisted type as the "OXIGEN and K50"model available on request (optional); in the second case, having two connections valves (preferably) a traditional open circuit regulator could be connected to the second valve, however it would be better to use a specific balance power-assisted Nitrox model.

Note: before diving, always and carefully verify that no loss of gas occurs through the connections to the valves and that the second stage is not free flowing; in both cases the estimate endurance is reduced.

HANDLING AND CORRECT USE OF THE UNDERWATER BREATHING APPARATUS

The underwater breathing apparatus is equipped with a rigid container (suitcase type) for transport. Therefore it is advisable to take the underwater breathing apparatus out of the container just before use.

DIVING

Operations to dive correctly are the following:

- block the tank to the back side of the buoyancy control device which must be leaned downward to avoid accidental tank falling;
- connect the pressure reducer to the tank valve;
- insert the filter into the transparent canister of underwater breathing apparatus, close it carefully, control that the o-ring is correctly positioned, keep the white envelope;
- close the spheric valve positioned on the constant flux hose (blue colour);
- open the high pressure valve and verify absence of leakage from the valve and from the alternate air source;
- check the tank inner pressure through the pressure gauge;
- put on the buoyancy control device and verify belts conditions;
- assemble the underwater breathing apparatus to the buoyancy control device: first connect the quick release on shoulders, then those on the hips, then the underlegs strap and finally regulate tension correctly. Remember that during the dive straps will losen because of wet suite crushing.
- check that the mouthpiece lever is closed;
- connect the blue coloured hoses coming from the pressure reducer to the quick release connections positioned on the counterlung body;
- open the spheric valve for constant flux, verify that the counterlung membrane everts until exhaust valve starts working; then open the mouthpiece lever and have a few deep breathings exhaling from the nose, until complete everting of the counterlung membrane in order to test the correct functioning of the supply automatism.
- Check that the alternate air source works correctly, then dive into water;

remaining on water line and keeping the mouthpiece in mouth, check that the straps are correctly regulated, then start diving.

- During the dive it is possible to eliminate possible condensate or water accumulated in the filter canister on the following way: with one hand press for a few seconds the counterlung membrane to avoid the complete expansion, at the same time press on the side on the exhaust valves stalk placed on the transparent filter canister, the liquid will be immediately expelled.

Note:Remember to turn off the lever before removing the mouthpiece, otherwise underwater breathing apparatus will flood immediately, preventing the dive.

At the end of the dive, when out of the water line, proceed as it follows:

- Completely inflate the buoyancy device, close the mouthpiece lever and take it out of mouth, then shut the spheric valve of constant flux;
- On board, remove the blue coloured hoses from the counterlung body;
- open the quick release buckles to remove the counterlung from the buoyancy device, open the one on the left shoulder for last and lay flat the underwater breathing apparatus;
- remove the buoyancy device and lay it flat;
- if another dive is not foreseen in a short time, remove the filter from the canister and keep it in its white bag, keeping note of remaining filter endurance;
- remove the pressure reducer from the valve letting out residual gas through the alternate air source or through the jacket inflator button;
- wash the full equipment with fresh water as soon as possible, then dry it out of direct sunlight and store it in a proper container.

MAINTENANCE OF THE UNDERWATER BREATHING APPARATUS

Every equipment for underwater use should undergo a careful periodical maintenance in addition to after dive washing; similarly to a traditional underwater open circuit breathing apparatus, also the underwater breathing apparatus with partial recycling of exhaled gas should be handled as follow:

INTERNAL WASHING

If after first use underwater breathing apparatus stays unemployed for a while or it will be used by different persons, it is absolutely necessary to wash it internally with water and a specific cleansing lotion (for example, light Sodium Hypochlorite).

The procedure is very simple and no special tools are needed:

- take out the filter from the canister,
- shut the mouthpiece lever,
- pour liquid with a specific detergent into the transparent canister (nearly 1 lt.);
- shut the plug of the transparent canister;
- lift the underwater breathing apparatus and rotate it completely several times, verify that the liquid can pass several times through the wrinkled hose, then through the canister;
- open the plug of the canister and pour out the contained liquid completely;
- tore in a dry place.

Note: This very simple operation should be done every time the underwater breathing apparatus is used by a different diver and/or it stays unemployed for a while in order to eliminate possible bacteria.

PERIODICAL MAINTENANCE

At least once a year underwater breathing apparatus must undergo the following maintenance procedure:

- open the counterlung, unscrew the four screws on the shield and the twelve screws sited on the ring nut that presses down on the membrane, keep the screws in a container to avoid losing them; pay attention not to detach the membrane from the ring nut that presses down on the membrane;
- check that the membrane is perfectly intact both inside and outside;
- verify that the o-ring sited on the piston integral and the exaust valve special membrane are intact and that the piston can slide smoothly, if necessary lubricate the seat with oxygen compatible grease/oil;
- check that in the counterlung body there are no dirt and/or traces of mould and/or bad smell, if so clean with a suitable liquid detergent;
- check that the sintered filter and the sonic nozzle inside the injection link are clean and have no signs of oxidization, if so replace them, as the calibrated hole sited on the titanium nozzle can become obstructed and the gas flux can be reduced;
- check that the mouthpiece is in perfect conditions, the lever can rotate correctly and the recovery membranes located in the wrinkled hose are intact and perfectly clean, assemble the wrinkled hose in proper seat and block it with special rubber seals (these must be replaced if worn and/or cracked);
- assemble the membrane and close again the counterlung, correctly screwing the screws in the proper seats; pay attention to rotation and positioning of the ring nut that presses down on the membrane as the counterlung can be closed only in one direction.
- inflate the counterlung and close the mouthpiece lever, then, with a light pressure on the membrane, verify that the membrane does not introflex to be sure that there are no missing elements and the whole equipment has been reassembled correctly;
- connect the pressure reducer to the tank and verify that the constant flux is the right one according to the used nozzle (if the injector marks 40, the flux should be of 9/9,5 lt. per minute for a maximum depth of 30 meters; if the injector marks 32, the flux should be of 14/14,5 lt. per minute for a maximum depth of 40 meters).
- Verify that the counterlung automatic by-pass works correctly and no free flowing is present; with the mouthpiece lever open, press the membrane downward on the by-pass to start the supply, repeat it several times, then shut the constant flood steel sphere, close the mouthpiece lever and check that the membrane stays still, otherwise contact authorized assistance.
- Verify that the exaust valves sited into the filter transparent container are free and operating: keeping the mouthpiece lever closed, press the membrane simultaneously and slightly shift the exaust valves stalk.
- Store underwater breathing apparatus in its container.

WARNING: THIS MANUFACTURER INFORMATION REPORT INTEGRATES BUT DOES NOT REPLACE THE USE AND MAINTENANCE GIUDEBOOK FURNISHED WITH UNDERWATER BREATHING APPARATUS T.I.R./SPACE 40; UNDERWATER BREATHING APPARATUS T.I.R./SPACE 40 CAN BE USED ONLY AFTER ATTENDING A SPECIFIC COURSE HELD BY QUALIFIED TRAINERS.

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