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## **REBREATHER SATORI passive semi-closed circuit (pscr)**

**directions for use and service**

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**Warning:** Diving with SC Rebreather may cause situations endangering life if not resolved urgently and quite correctly.



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## **1. Introduction**

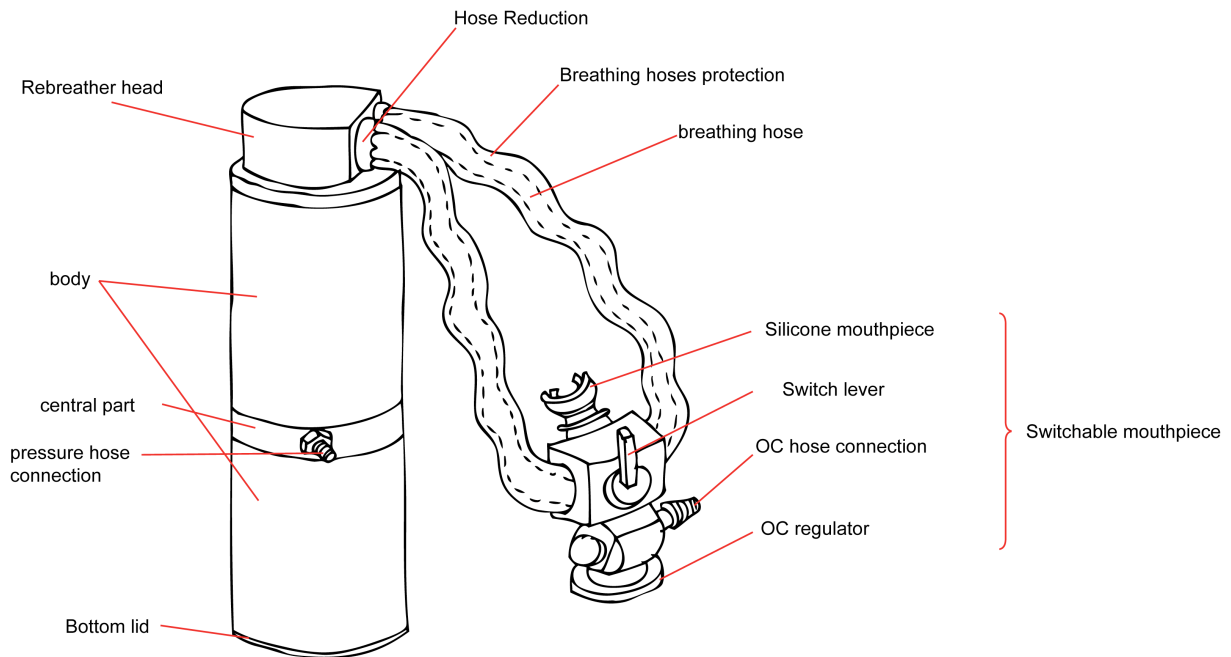
The diving with PSCR is in many respects different from the diving with an open circuit having been used by you till now. You can learn necessary information when reading this user's manual helping you to use SCR SATORI for a long time and dive with it safely. Put aside your self-confidence acquired by using an open circuit, everything is upside-down with SCR than you have been apt till now. The number of strong points of the apparatus is, as it is in other spheres of life unfortunately, recovered by several potential risks which must be eliminated to a minimum possible extent.

Before the first dive it is necessarily required to familiarize with SCR SATORI perfectly and to understand its construction and the way of its operation but also to handle safely all diving procedures using this apparatus including the resolution of crisis situations.

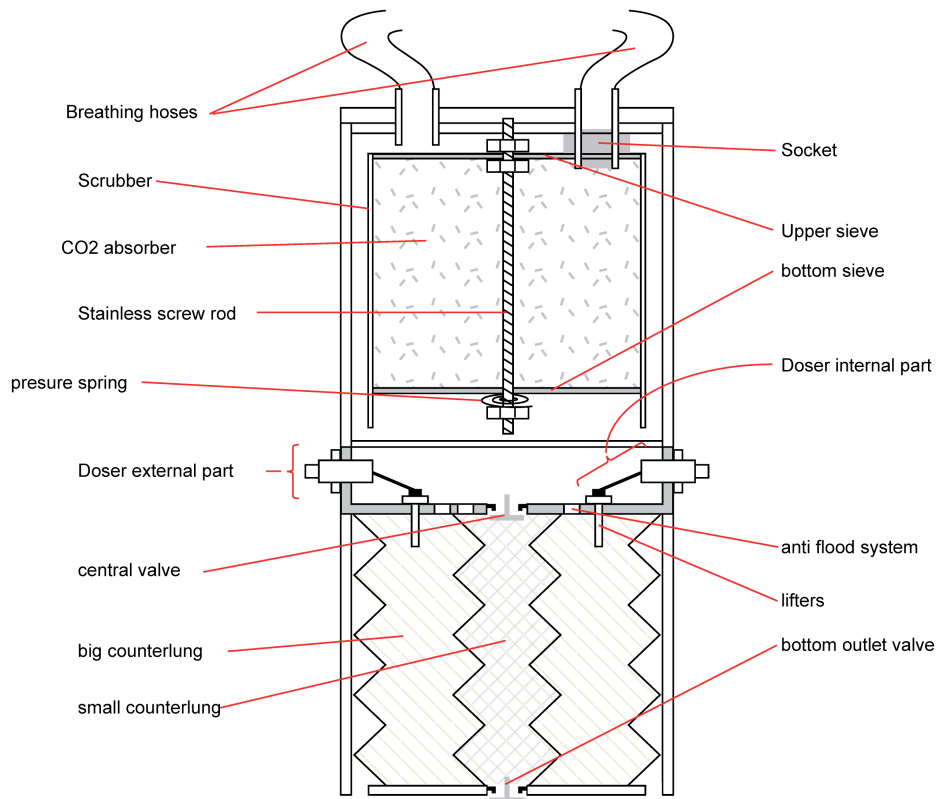
## **2. Construction of RB SATORI**

The perfect knowledge of technical specifications is a quite fundamental prerequisite for a safe, effective and comfort use of SCR SATORI. Here, we will describe the principles of the apparatus functioning, support them by well-arranged drawings. Please devote maximum attention to this chapter. The understanding of its content is necessary for easy service of SCR SATORI and pleasant experiences in it.





**Picture no. 1 - Description of external parts of RB SATORI**



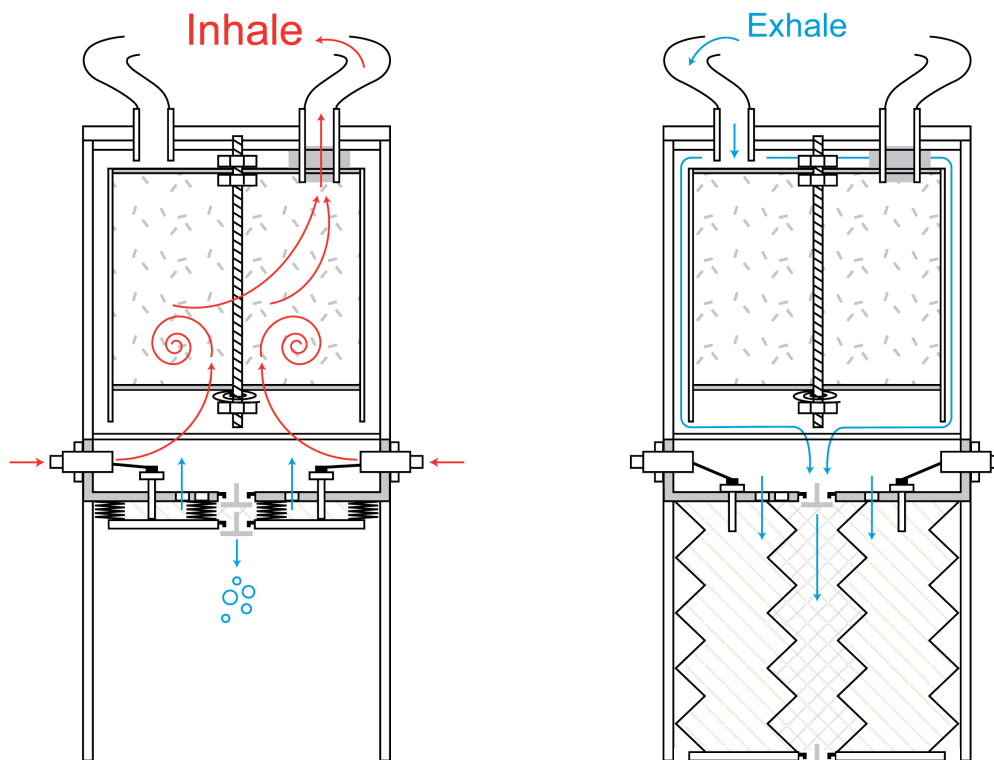
**Picture no. 2 - Description of internal parts of RB SATORI**



## 2.1. How RB SATORI works?

What proceeds in the apparatus when breathing through the closed circuit?

The moment your first inhale from the SCR apparatus, both the counterlungs are in a maximum spread position. The breathing mixture from the big counterlung goes through the central part through the “anti-flood” vent holes to the scrubber, where it passes through CO<sub>2</sub> absorber to the left breathing hose, to switch mouthpiece and to the diver’s mouth. The counterlungs get partially empty.



Picture no. 4 - Section, function of RB SATORI



When exhaling, the breathing mixture oxygen-depleted by metabolism passes through the switch mouthpiece to the right breathing hose. Through this it passes to the rebreather head, then goes through fall ducts in the double body back to the central part. There, a little part gets by a one-way valve to the small counterlung and a dominant part gets back to the big counterlung. With the next aspiration, the devaluated breathing mixture from the small counterlung is released to the surrounding environment. The volume of the big counterlung decreases by the amount of the released part, comparing to the first aspiration. After several breathing cycles, the volume of the big counterlung decreases so that it pushes the injector levers which supplies the fresh breathing mixture.

By the changeover to the open circuit, the mixture is led directly from the pressure bottles to the switch mouthpiece by the moderated pressure hose, as well as by a common open circuit diving breathing apparatus.

## **2.2 Technical data and used materials**

### **Technical data:**

- external diameter - 180 mm
- height - 700 mm
- weight - 12 kg
- scrubber contents - 3 kg

### **Used materials:**

- rebreather head: black DELRIN- Dupont registered
- hose reduction - black DELRIN- Dupont registered
- central part - black DELRIN- Dupont registered
- injectors - anodized aluminium/stainless steel
- lifters - black DELRIN- Dupont registered, stainless spring
- middle valve - black DELRIN- Dupont registered, stainless spring, silicone gasket
- RB body - PVC - U



- scrubber - PVC - U, closed by black DELRIN lid, stainless screw rod, diameter 8mm, spring - stainless steel
- bottom lid - black DELRIN- Dupont registered
- small counterlung - Hypalon - Dupont registered, thickness 1mm
- big counterlung - Hypalon - Dupont registered, thickness 1mm
- counterlung lid - black DELRIN - Dupont registered
- switch mouthpiece - black DELRIN- Dupont registered, IIInd stagestagestagestage automatic RG4
- breathing hose - reinforced hose with smooth inside wall - inside diameter 38 mm
- breathing hose protection - Cordura 1000 - Dupont registered

Rebreather SATORI has a double coating which minimizes the cooling of the CO<sub>2</sub> absorber during the dive which increases its endurance and extends its functioning cycle. Therefore it is not necessary to use thermal-insulation wet suit cover for the upper part of the body.

### **2.3 CO<sub>2</sub> absorber**

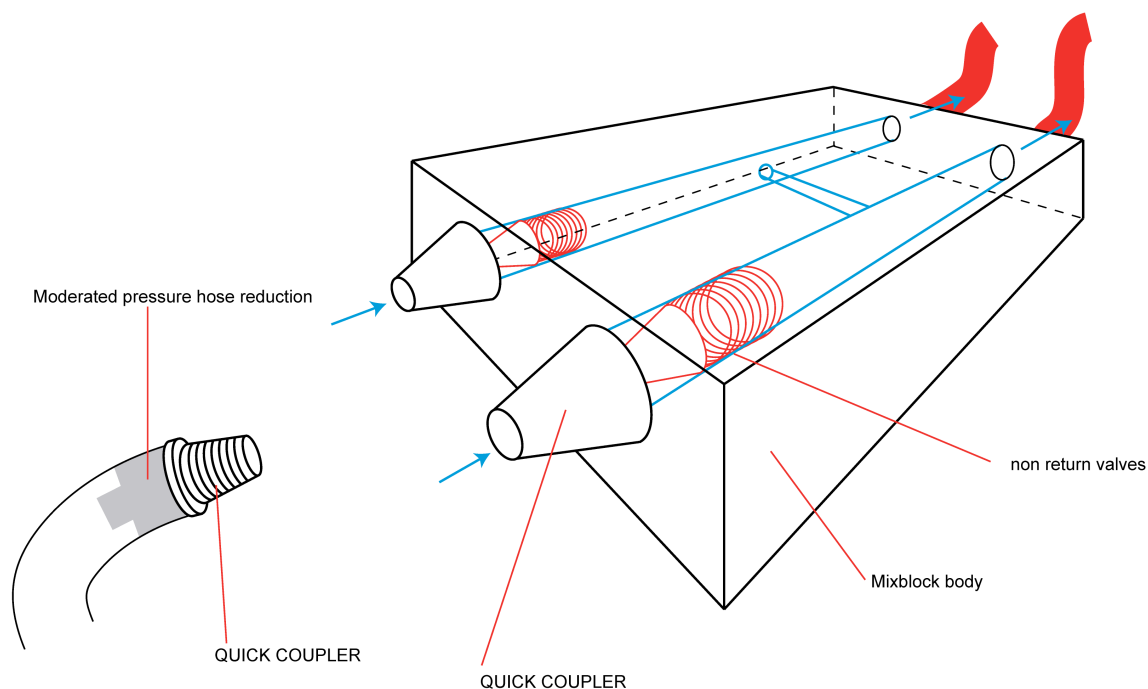
Most often, the CO<sub>2</sub> absorbers are hydroxide ones operating on the principle of the known reaction of lime (slaked lime) and carbon dioxide. However, for the optimum reaction course there is a certain amount of sodium hydroxide, eventually caustic potash additional, as a catalyser, and as well as water. Absorbent is usually supplied in the form of granules.

### **2.4 Construction of mixblock - SATORI mix**

- body of a mixblock, aluminium (elox)
- moderated pressure reduction to quick couplers, stainless
- moderated pressure hose reduction, aluminium (elox)
- quick coupler stainless
- inside 2x stainless string and 2x check valve of black DELRINU - Dupont registered



*SATORI mix* is simple in respect of construction. Its dominant function is the possibility of breathing gas exchange whenever during the dive. The absence of any switch mechanisms eliminates the possibility of unwanted or self-switch, eg when the diver is passing through restrictions in caves or wrecks. It significantly increases the safety of the system. The other safety element is a doubled “mini-circuit” in the mixblock, see Picture 6



**Picture 6 - Mixblock**

### **3. Important data**

#### **3.1 Breathing medium - gas**

The apparatus is determined for diving with all kinds of common breathing mixtures including mixtures such as heliox or trimix, with the content of oxygen up to 40%. For using mixtures with a higher oxygen content it is necessary to provide the apparatus with a set of viton O-rings and clean for use with oxygen (oxyclean). Due to the drop of PPO<sub>2</sub> in a breathing loop during the dive, it is necessary to plan the composition of breathing mixtures



with respect to the assumed depth of the dive using the equivalent table of *SCR SATORI*. The mixtures with an oxygen content lower than 40% when breathing on the water level or in small depths through the semi-closed circuit are hypoxic - Chapter 12.

The breathing gas quantity you bear in the bottles must always be so that in case of the apparatus failure safe return on the water level is possible when using the open circuit. For the decompression and cave diving the same quantitative and safety rules of the gas management are valid as for those with an open circuit.

### **3.2 Balancing**

SCR SATORI has a positive buoyancy, therefore it is necessary to balance the equipment with RB SATORI so that when the pressure bottles are nearly empty, the loss of breathing gases weight will lead to unwanted egression. When diving with SCR SATORI, the buoyancy of the diver is not changed in relation to breathing as we know it in relation to the equipment for an open circuit.

### **3.3 Buoyancy control**

For the buoyancy control, when diving with SCR SATORI, a common BC compensator is used with a back plate - the so-called wing. Due to the weight of the apparatus and necessary balancing a wing with a sufficient volume - buoyancy is required. When joining to the bottles a “triple assembly” is taken into account needing a wing of a proper shape. For specific types of diving, SCR SATORI in configuration with an apparatus located on the wing and side-mount bottles may be used. The specificity of these configurations affects the selection of a right type of the buoyancy compensator.

### **3.4 Strong points of SCR SATORI**

There is quite a number of reasons for diving with the SATORI apparatus. Generally, the device is intended mainly for technical and cave diving. Its use for leisure diving is possible, however, it demands a higher level of responsibility than it is usual for the open circuit use.



Comparing to the open circuit, the most important advantage of diving with SCR SATORI is 8 times lower consumption of breathing gas. This brings along a number of secondary advantages. A long time spent at the bottom gives the opportunity to plan dives more efficiently, to solve one's own or buddy's possible critical situations. The level of safety is obviously increasing comparing to the open circuit. The absence of any control electronics and mechanical simplicity makes the SCR SATORI rebreather a great choice comparing to electronically controlled, fully closed CCR devices. A large number of fatal accidents could have been eliminated by using the rebreather. This aspect, along with the economical efficiency, makes this apparatus a very attractive investment.

The warmth comfort while breathing is another essential advantage of this SC rebreather. While using the open circuit, the central part of the human body is cooled down by the cold and dry breathing gas. Besides considerable physiological negatives of this process, there is a threat of freezing of the first-stage regulator, due to high flows. With SCR SATORI, both these essential risks are significantly reduced or completely eliminated.

With some specific subaquatic activities, it is necessary or suitable to eliminate the exhaled bubbles which may disturb the surrounding environment. This concerns for example subaquatic photography when the exhaled bubbles can disturb some shy water creatures or cave diving in areas where the exhaled bubbles break down sediments settled on walls or ceilings and thus initiate a potentially hazardous situation. These negative aspects are removed by SATORI rebreather.

The absence of the control electronics not only makes the SATORI rebreather a very safe apparatus. It is also a reason for low maintenance requirements. This is possible without any special tools and after training it can be actually done in domestic conditions, or even complicated domestic conditions eg. without any electric connection.

### **3.5 Weak points of SCR SATORI**

The only objective negative feature of RB SATORI is a very perceivable change of breath resistance when changing the position of the diver's body. This phenomenon is caused by placing the counterlungs out of the horizontal axis, in which the diver's lungs are located



physiologically. The counterlungs are affected by the head pressure, which compresses or, on the contrary, expands - spreads them depending on the tilt towards the horizontal axis.

In the “upside down” position of the diver, the air in the counterlungs pushes towards the level, the breath resistance rises by the necessity to overcome this pressure. On the contrary, in the “head to the level” position of the diver, the head pressure affects the counterlungs, they compress and a bigger breath resistance rises. This phenomenon can be fully eliminated by the correct position of the diver during diving.

### **3.6 RB SATORI handling**

- \* Do not stand the apparatus so that it may fall down from a height or on a hard mat.**
- \* Do not lift the apparatus taking it for breathing hoses.**
- \* Do not use force in service operations or maintenance.**

#### **3.6.1 Apparatus dismantling**

The SATORI apparatus is fully mechanical and can be, using simple tools, dismantled, for the most part without being able to complete any subunit easy by return. However, we recommend to only perform basic necessary maintenance described in Chapter 8. Some parts are fixed by cement in the apparatus, such joints must not be split. The robust apparatus construction significantly eliminates the possibility of damage of the external structure in the contact with the environment. Inside the apparatus there are mechanical parts, which may be damaged by wrong handling. Do not use brute force when dismantling the apparatus.



### **3.6.2 Apparatus assembly**

When assembling the SATORI apparatus, we recommend to use the same joint and connecting material for respective joints of the construction. Particular parts adapt to one another and subsequent casual assembly could cause untightness. When completing, always clean all parts of the apparatus construction from mechanical impurities and spread “O-rings” with silicone vaseline, eventually with oxygen-compatible lubricant.

## **4. Pre-diving preparation**

Well-taken subsequent steps are quite an essential and necessary pre-diving routine to be performed immediately before every dive. Failure to perform the above-mentioned recommendations will cause problems sooner or later, which may mean life threatening.

### **4.1 Functionality check**

Before every dive it is necessary to check the function of main, vital mechanisms of RB SATORI. The basic check can be performed visually. All parts of RB must be in a proper place and in a proper position, breathing hoses must not show signs of damage or crack, the rebreather head must be properly fixed and protected. In addition, it is necessary to perform the check of a right breathing gas exchange in the circuit, ie the function of particular parts of the circuit providing this exchange. First, check the tightness of the check valve on a small counterlung and then gas dosing to the circuit.

### **4.2 Counterlung functionality check**

Tighten the outlet valve in the bottom part of RB and move by the counterlungs inside just as it is done when breathing. Upon every pushing, the counterlungs inside the body of the rebreather, the air in the small counterlung must escape outside, which is well-audible. Afterwards, release the outlet valve to the position of the minimum resistance of the escaping mixture.



### 4.3 CO2 absorber - scrubber check

Check the CO2 absorber - scrubber and ensure that it is properly closed, its quantity is sufficient and that its expiration is not exceeded. When diving in winter, the recommendations described in Chapter 9 of the User's Manual shall be observed. **The safe life of the CO2 absorber means a six-hour operation!! Do never exceed this value! Do not use an absorber if you are not sure of its condition!!**

The CO2 absorber granules must be properly trampled down but not broken so that so-called channelling - the mixture passing through only a few channels may not take place. Then, for the CO2 absorption a total volume of the chemical substance would not be used but only granules in the surroundings of the channels and after spending the potential of these granules, the absorber would start to leak carbon dioxide and become functionless. The CO2 absorbers are used even for medical purposes, in anaesthesia. For the use in rebreathers, special absorbers are manufactured with a bigger amount of fixed water (12 -19 % compared to 7 -15% in absorbers for anaesthesia) and in different grain sizes.

We recommend to use the SATORI sorb absorber determined for use in the SATORI apparatus, it has a very low dustiness and its high efficiency is guaranteed for the 6-hour operation. The SATORI sorb is provided with an indication dye, which is only an identification indicator of the absorber functionality, in no case this indication must replace proper monitoring its exposition.

The above-mentioned pre-diving procedures can be performed without RB connecting to the pressure bottles. Next phases of the check must already take place after their connection to RB as mentioned in Article 4.5.

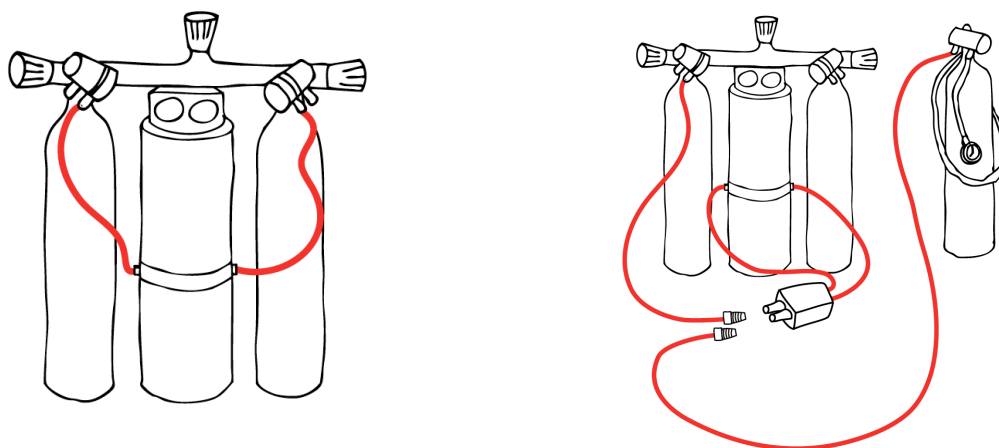
### 4.4 Fresh breathing mixture dosing check

Subsequently, the dosing of a new mixture to the breathing circuit shall be tested. We connect the moderated pressure hoses from the first stage of automatics. We open the bottle valve and push down the counterlungs inside the apparatus body so that levers may press down the injectors. These must immediately react and indicate a proper function and correct adjustment by a loud hiss.



#### 4.5 Connection of the apparatus to the pressure bottles with breathing gas

For the connection of RB SATORI to the pressure bottles any of the 1st stages of the breathing automatics may be used. We recommend to use the first stage SATORI RGX 2 having an ideal construction for a proper conduct of moderated pressure hoses either to the rebreather body or to the other parts of the diver's equipment.



Picture 7 - Bottles connection

#### 4.6 Moderated pressure hoses for connection of pressure bottles

We recommend to use a set of moderated pressure hoses *SATORI pipe* meeting the use of majority of available pressure bottles. Before screwing the moderated pressure hoses, we recommend to spread properly all tightening “O-rings” so that when connected, these may not be damaged.

#### 4.7 Fixing of pressure bottles to RB SATORI

The pressure bottles must be properly fixed to the RB SATORI body so that they may not be released during diving. The *SATORI flip* is possible, eventually as well as another constructional solution as required by the user. When using *SATORI flex* manifold or another fixed connection of bottles, absolute connection strength of the bottle with RB SATORI must be ensured.



#### **4.8 Connection of the apparatus to the buoyancy compensator**

If all above-mentioned items of the pre-diving preparation are executed, RB SATORI may be connected to the buoyancy compensator, the hose may be connected to one of the first stages, the moderated pressure hose may be directly to the switch mouthpiece. The recommended way of connection is shown in the following diagram.

**IF YOU IN DOUBT ABOUT YOUR EQUIPMENT, CANCEL THE DIVE!**

### **5. Diving with RB SATORI**

#### **5.1 Water entry**

After the performance of the pre-diving check and entry into water with RB SATORI the mouthpiece must be switched to the position for an open circuit. The position of the switch lever must be vertical, the lever is visible even if you have the mouthpiece in your mouth. We always recommend to enter into water with the apparatus switched to an open circuit and switched to the closed one at a depth of approximately 3 m or at such you are allowed by PPO2 breathing gas.

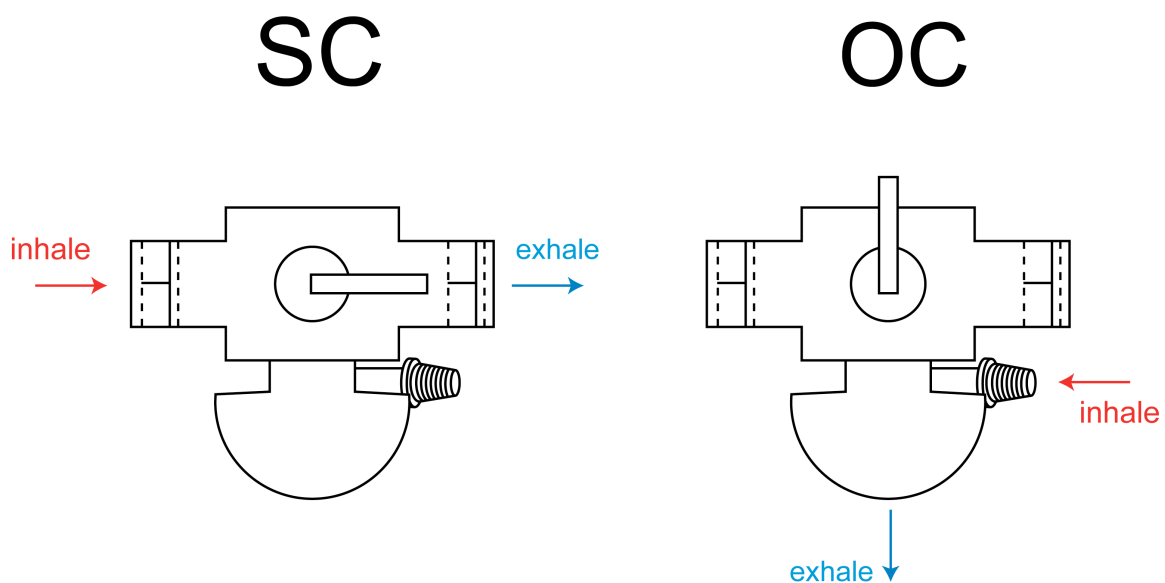
When jumping into water is necessary, a water level stroke to the below-opened chamber of the rebreather, in which counterlungs are located, has to be eliminated. By this stroke, they may be broken or damaged or subsequent life threatening complications may occur. Therefore jump from the smallest height, eventually on the back, so that the water stroke may be absorbed by external apparatus structures.

The outlet valve must in the position "open" during diving.



## 5.2. Switch mouthpiece operation

As a standard, RB SATORI is supplied with a switch mouthpiece allowing whenever during the diving to switch to an open or closed circuit. You never get out the switch mouthpiece from your mouth, unless it is switched to the vertical position, ie to the open circuit. The apparatus would be flooded. This is obviously valid even when entering water, the switch mouthpiece must always be switched to the open circuit before water entering.



Picture 8. - Position of the switch lever when switched to the open circuit and closed circuit

## 5.3 RB SATORI water functionality check

Immediately after diving, the apparatus tightness check, ie the so-called bubble check, has to be performed. To check acoustic shows of the apparatus. At every breath a small escape of bubbles from the apparatus should be audible. If the bubbles escape, it means that the devalued gas escapes from the breathing circuit. The complementary injection of the fresh mixture to the breathing circuit can also be well-checked acoustically at the moment when the levers start to press down to the injector. This moment is accompanied by audible hiss. If



fresh gas comes and the gas devalued by metabolism escapes, the apparatus operates perfectly and the diving to bigger depths may start.

#### **5.4 Dive**

Own breathing through the semi-closed circuit starts when you exhale to water, switch the lever on the mouthpiece to the horizontal position and breathe in through the rebreather. Thus, it is filled with gas. If the counterlungs are full of gas in a fully spread position, ie far away from the injector levers, it is uneasy to exhale to the rebreather and get the whole content of lungs out into water. Therefore, the more suitable is to exhale through a mask or the open circuit and then to inhale from RB. Next breathing is quite smooth and comfortable.

PPO2 does not drop nearly in case of quicker diving because the counterlungs are pressed down by surrounding pressure and therefore fresh breathing gas is supplied to the circuit all the time.

**WHENEVER IN DOUBT, SWITCH TO THE OPEN CIRCUIT!**

#### **5.5. Breathing when diving**

Due to the above-described technical parameters of the apparatus, the breathing comfort depends at most on a proper position of the diver's body under water.

There is likely to be a lot of techniques providing a pleasant and easy way of breathing with SATORI, everyone certainly finds an ideal position. We recommend to keep a quite horizontal position or only by a few stages above this level.

A sufficient reserve of breathing gas allows quite free and deep breathing. The same way as diving with the open circuit, the perfect lung ventilation is of a vital importance. The rebreather SATORI allows to eliminate breath holding during diving in full in order to save breathing gas.



### **5.5.1. Safety OC breaks**

Keep thoroughly safety breaks when breathing with rebreather and always once per 3 - 5 minutes switch to the open circuit or exhale to the mask. In this way, breathing gas in the rebreather is exchanged for a new and fresh one.

### **5.5.2 How to diagnose CO<sub>2</sub> poisoning?**

If you use the recommended CO<sub>2</sub> absorber, do not exceed the determined time for its use and observe recommendations of this Manual, the occurrence of the CO<sub>2</sub> poisoning is quite minimum. In spite of it, you must know its symptoms and the way how to behave in case you find out these symptoms.

The start-up of the CO<sub>2</sub> poisoning is very difficult to recognise, nearly to the moment when the poisoning shows. It shows by breathlessness, disability to hold breath and more advanced stages by visual hallucinations or loss of visual resolution, disability of coordination and muscular asthenopia. The only way how to diagnose the poisoning during diving is a short, approximately 5-second, breath holding per each c. 5 - 10 minutes. If you do not observe increased breathlessness and bad ventilation feelings, all is in order. If such signs occur, you must change to the open circuit and accompanied by the buddy to rise immediately above the water level and seek medical advice.

### **5.6 Change of the diver's position when diving**

When a distinct change of the diver's vertical position under water is necessary, there will be two extremes in connection with breath resistances. In the position "upside down" and as well as in the quite straight position, the breath resistance will be high. Therefore, we recommend either to minimize the time you will be in the above-mentioned positions or to switch to the open circuit in these positions, and immediately after returning to the standard diving position - trim - to switch again to the closed circuit. Turning around the horizontal axes of the diver does not affect the diver's comfort. Turning around the horizontal axes of the diver does not affect the diver's comfort.



## 5.7 Ascension

When ascending, the breathing gas in the counterlungs is spread. The counterlungs are full all the time and no exchange of the devalued breathing by metabolism is done. Therefore, it is necessary to exhale to the mask or water by each three meters at least so that the counterlungs may be emptied out and push the injectors releasing fresh air into the circuit, eventually to switch to the open circuit during the change of the depth towards the level.

## 5.8 Decompression

The decompression procedures must be modified compared to the open circuit in dependence on the drop of the partial oxygen pressure in the loop according to the provided table of suitable gases for the given depth, see Chapter 11.

We recommend to use the decompression software allowing to take into account this change.

**\*In no case any decompression table determined for the open circuit must be applied to the calculation!**

## 6. Resolution of crisis situation

**\*WHENEVER IN DOUBT, CHANGE TO THE OPEN CIRCUIT!**

### 6.1. Apparatus flood

The apparatus is flooded upon unwanted or careless removal of the mouthpiece from the mouth during diving without switching the mouthpiece to the position of the open circuit. Water flows through the mouthpiece to the counterlungs and through the vertical fall line along the scrubber body to the central part and counterlungs.

This situation can be managed in this way that you bend backward, inhale through the open circuit, switch to the closed one and exhale. This procedure may be repeated several



times until all water is removed from the apparatus. In case, only a small flood occurred, the diving may continue after perfect water removal from the circuit. The absorber is protected against flood by the scrubber walls. If massive flood occurred, it is necessary to change to the open circuit immediately and to stop diving.

The flooded absorber is a strong caustic with which no tissue should come into contact. The biggest danger threatens if water penetrates into the breathing circuit to a such extent that it flows through the absorbent and creates a fluid caustic („caustic cocktail“), which may get to the mouthpiece and upper airways. The burn of the oral cavity and throat is very dangerous (mouthpiece must be immediately get out, to spit up the rest of “cocktail”, flush out the mouth with water and swallow other water and change to the stand-by - bailout - system).

## 6.2. Loss of acoustic indication of RB condition

**\* Upon each aspiration - bubble fizzle, upon each 5th - 7th hiss of mixture injector!**

In case of loss of the acoustic indication of the rebreather condition the check of functionality in cooperation with the buddy must be performed. If small bubbles leave the apparatus regularly upon each breath, everything is in order. If no, **change to the open circuit without delay and stop diving!**

## 7. Connection of stage bottles - diving with mixblock

The mixblock *SATORI mix* supplied as a standard allows not only to extend time possibilities of the rebreather when diving, but also to connect decompression mixtures from stage bottles through a closed circuit and to increase the total potential of the system distinctively.

The mixblock handling and use of decompression mixtures require a lot of responsibility and careful planning of diving. **Use of improper breathing gas may kill you!**



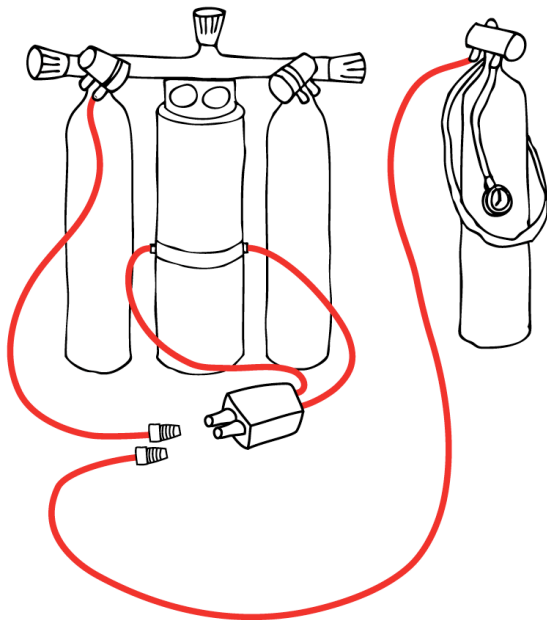
Terminations of moderated pressure hoses must be distinguished visually and tactually due to an unwanted change of gas upon the loss of possible visual control.

The exchange of breathing gases source, when using *SATORI mix*, is performed by the connection of the stage bottle to the mixblock by a moderated pressure hose with a quick coupler. This way, only one decompression mixture may be connected in one moment, in case of simultaneous connection of bottles with different mixtures, these will be mixed and devalued in the mixblock.

Two moderated pressure reductions to the quick couplers are determined either for the connection of bottles with the same breathing gas without the use of the manifold or as two separate connections for the stage bottles, which consistently complete the doubled system of the whole rebreather.

The use of SATORI mix is possible in several below-mentioned ways, different regulations are valid for each of them:

#### 7.1. Mixblock + manifold + stage



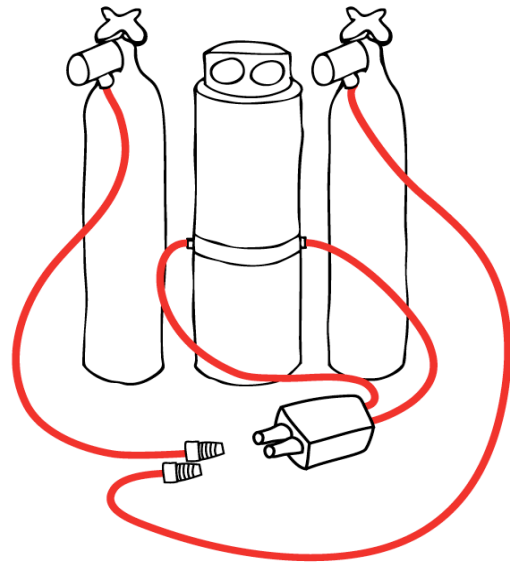
"Back gas" bottles are interconnected by a manifold, the mixblock is connected to the rebreather, to which "back gas" or any stage bottle may be connected.

**Picture 11 - mixblock + manifold + stage**



## 7.2 Mixblock - NO manifold

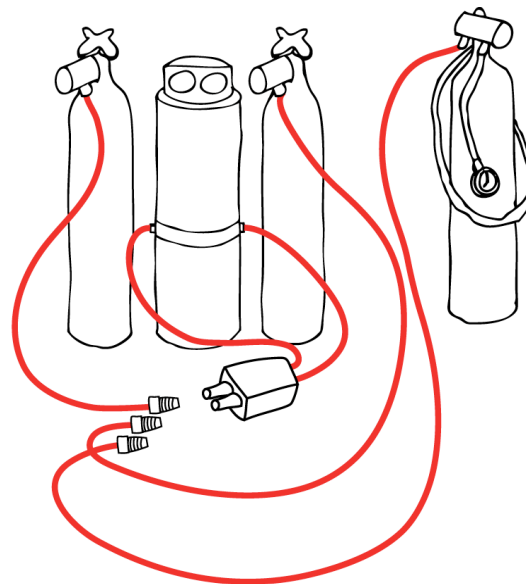
"Back gas" bottles are not interconnected with the manifold, the mixblock is connected to the rebreather, to which "back gas" bottles may be connected by turns, in which different gases may occur. When using the above-mentioned connection, it is necessary to have two separate manometers because in each "back gas" bottle the breathing air is running low in another way.



**Picture 12 - mixblock - NO manifold**

## 7.3 Mixblock - NO manifold + stage

"Back gas" bottles are not interconnected with the manifold, the mixblock is connected to the rebreather, to which "back gas" bottles with different gases may be connected by turns or any stage bottle may be connected to the mixblock. For such a connection, two separate manometers have to be available, in each "back gas" bottle the breathing air is running low in another way.



**Picture 13 - mixblock - NO manifold + stage**



## **8. After diving**

For the reliable and safe function of the SATORI rebreather a few simple service actions must be performed regularly after every dive or at the end of every diving day at least.

### **8.1 Removal of water from the system**

Due to hygienic reasons, we recommend to remove water from the system which may be collected there during every dive. Remove the rebreather head and turn it all upside down so that water from the central part and counterlungs may flow off spontaneously. The counterlungs must be straightened and shrunk several times so that water from the bends may be removed effectively.

The apparatus, not dried for a long time, smells bad and starts to be a significant hygienic risk!

### **8.2 Removal of mechanical impurities**

Remove all visible mechanical impurities from inside and outside the apparatus and rinse it all with fresh water. This has to be done particularly when diving in caves or in sea water.

**\* Do not rinse the apparatus with water warmer than 30°C.**

### **8.3 Release of packing "O" rings in the breather head**

To store the rebreather always with its head separated so that "o" rings may not be strained and sufficient fresh air ventilation may be provided in the whole apparatus.

When completing it subsequently, we recommend to lubricate "o" rings with silicone vaseline or oxygen-compatible lubricant.

### **8.4 Hose drying**

We recommend to dismantle breathing hoses, rinse them with clear tepid water, eventually with a small amount of detergent and leave them to dry up carefully when storing



them. When dismantling breathing hoses, disconnect them only from the rebreather body not from the mouthpiece.

Switch the mouthpiece to the position of the closed circuit after every dive, this way you will achieve air circulation in breathing hoses and their drying up.

### **8.5 CO2 absorber drying**

See instructions of absorber manufacturer always.

### **8.6 Visual check**

Check visually all parts of the rebreather and make sure that no part is damaged or its functionality limited.



## 9. Maintenance

The SATORI rebreather is a very simple mechanical apparatus which does not need any complex maintenance. Compared to the open circuit needing maintenance roughly once a half-year or yearly, of course, the rebreather maintenance demands are bigger. In addition to

the standard after-diving maintenance described above and corresponding to the maintenance of the open circuit equipment in many items, in respect of SCR SATORI, the maintenance or renewal of some parts of the apparatus must be performed in set intervals. See Chapter 11.





## 9.1 Exchange of CO2 absorber

**\*Safe life of the CO2 absorber means a six-hour operation!!**

**\*Never exceed this set value!**

**\*Do not use the absorber if you are not sure of its condition!!**

The absorber renewal can be performed without any tools. After unscrewing the delrine holding-down cover on the bottom sieve, pour the CO2 absorber to the scrubber so that it will fill it approximately 1-2 cm under the bottom edge. Pay attention to that the absorber do not contain dust and granules are loose without loupes.

## 9.2 Disinfection

The SATORI SCR apparatus must be disinfected regularly. The frequency of such maintenance depends on the frequency and intensity of use. The rebreather must be disinfected carefully if used by another person. Due to the fact that during diving the rebreather becomes part of your respiratory system, it is necessary to eliminate potential hygienic risks.

Disinfect the apparatus by sufficiently diluted means for water disinfection eg SAVO (1:10)

## 10. Diving in winter

When diving in winter (+4 C° and less) you can see the advantages of SCR SATORI. Small breathing gas flows through the first stages of automatics nearly eliminate the possibility of the apparatus freezing. Warm and wet air inhaled by the diver from the closed circuit significantly eliminates the physiological risk connected with winter diving, undercooling and breathing the iced breathing gas.

Winter also brings some danger that it is to be eliminated totally. It is necessary to observe several below-mentioned vital recommendations.



When breathing through SCR SATORI, it becomes wet due to a chemical reaction in the CO<sub>2</sub> absorber. It is a quite harmless, normal condition under temperatures above the freezing point. Under temperatures below zero, however, the freezing of the CO<sub>2</sub> absorber in the scrubber starts to threaten. It results in the full loss of the absorber functionality. Before diving, the rebreather has to be kept in warm, be put out of operation after diving and repeated dives may be performed only after the apparatus and CO<sub>2</sub> absorber are perfectly dried up.

Under temperatures under the freezing point the water entering some parts of the rebreather can freeze and put some basic parts of the system out of operation.

**Diving in winter only with the apparatus 100% dry!**

**Do not inhale from the apparatus on the water level!**

## **11. Service intervals**

We recommend to send the apparatus to the service centre for check once a year at least. The first service check is always free of charge.

If the pre-diving preparation and maintenance are carefully executed, other operations may not be done more than once a 3-4 months. Of course, all depends on the intensity and way of the SATORI rebreather use.



## 12. Table of PPO2 changes when using the closed circuit

EAN	10%	12%	15%	18%	21%	25%	32%	40%	50%	60%	70%	80%	90%	100%
MOD	150m	120m	95m	75m	65m	50m	40m	30m	22m	17m	13m	10m	8m	6m
Hloubka	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2	PpO2
0									0,16	0,30	0,44	0,58	0,72	0,86
3							0,14	0,28	0,45	0,62	0,79	0,96	1,13	1,30
6							0,24	0,40	0,60	0,80	1,00	1,20	1,40	1,60
9						0,18	0,34	0,52	0,75	0,98	1,21	1,44	1,67	1,90
12					0,15	0,25	0,43	0,64	0,90	1,16	1,42	1,68	1,94	
15					0,21	0,33	0,53	0,76	1,05	1,34	1,63	1,92		
18				0,18	0,27	0,40	0,62	0,88	1,20	1,52	1,84			
21				0,23	0,34	0,48	0,72	1,00	1,35	1,70				
24			0,17	0,28	0,40	0,55	0,82	1,12	1,50	1,88				
27			0,22	0,34	0,46	0,63	0,91	1,24	1,65					
30			0,26	0,39	0,52	0,70	1,01	1,36	1,80					
33		0,16	0,31	0,45	0,59	0,78	1,10	1,48	1,95					
36		0,20	0,35	0,50	0,65	0,85	1,20	1,60						
39		0,24	0,40	0,55	0,71	0,93	1,30	1,72						
42	0,16	0,27	0,44	0,61	0,78	1,00	1,39	1,84						
45	0,19	0,31	0,49	0,66	0,84	1,08	1,49	1,96						
48	0,22	0,34	0,53	0,72	0,90	1,15	1,58							
51	0,25	0,38	0,58	0,77	0,97	1,23	1,68							
54	0,28	0,42	0,62	0,82	1,03	1,30								
57	0,31	0,45	0,67	0,88	1,09	1,38								
60	0,34	0,49	0,71	0,93	1,15	1,45								
63	0,37	0,52	0,76	0,99	1,22	1,53								
66	0,40	0,56	0,80	1,04	1,28	1,60								
69	0,43	0,6	0,85	1,09	1,34									
72	0,46	0,63	0,89	1,15	1,41									
75	0,49	0,67	0,94	1,20	1,47									
78	0,52	0,70	0,98	1,26	1,53									
81	0,55	0,74	1,03	1,31	1,60									
84	0,58	0,78	1,07	1,36										
87	0,61	0,81	1,12	1,42										
90	0,64	0,85	1,16	1,47										
93	0,67	0,88	1,21	1,53										
96	0,70	0,92	1,25	1,58										
99	0,73	0,96	1,30	1,63										
102	0,76	0,99	1,34	1,69										
105	0,79	1,03	1,39											
108	0,82	1,06	1,43											
111	0,85	1,10	1,48											
114	0,88	1,14	1,52											
117	0,91	1,17	1,57											
120	0,94	1,21	1,61											
123	0,97	1,24												
126	1,00	1,28												
129	1,03	1,32												
132	1,06	1,35												
135	1,09	1,39												
138	1,12	1,42												
141	1,15	1,46												







**13. Decalogue of safe diving with SCR SATORI**

- 1) If in doubt, change to the open circuit or cancel the dive.
- 2) Listen how the apparatus works.
- 3) Change the absorber after maximum 6 hours of operation.
- 4) Comply with the pre-diving preparation.
- 5) On the water level - open circuit.
- 6) Be more responsible.
- 7) In winter - dry rebreather.
- 8) Do not lend the rebreather.
- 9) Keep breaks for the open circuit.
- 10) Dive for joy, not for records.