INFORMATION NOTICE

TRITON® CHESTMOUNTED REBREATHER

M3S - SAS

Tourves, 22 Juin 2023

V2.1

Modifications history

Révisions	Dates	Descriptions
1.0	25/03/2015	Creation of the document
1.1	20/04/2015	Illustrations and minor changes
1.2	18/06/2015	Addition of illustrations on positions
1.3	26/09/2016	Various updates and corrections such as : • Warnings • Calibration on table 3.3.5 • Illustrations
1.4	27/09/2016	Text corrections
1.5	25/04/2017	Text corrections
2.0	14/06/2023	Recast of the notice
2.1	25/09/2023	Text corrections

Thank you for buying a mCCR TRITON® chestmounted rebreather.

This document is the user's information notice in relation to the assembly, use, maintenance, storage and transportation of the mCCR TRITON® chestmounted rebreather.

Contact:

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WARNINGS

UNDER NO CIRCUMSTANCES THIS INFORMATION NOTICE REPLACES A TRAINING COURSE CARRIED OUT BY A TRAINING ORGANIZATION RECOGNIZED BY M3S.

WHEN TRAINING, EACH TRAINING STANDARD POINTS MUST BE COVERED AND MASTERED AT THE END OF THE TRAINING COURSE.

THE REBREATHER MUST NOT BE USED WITHOUT AN ADEQUATE TRAINING.

THE REBREATHER MUST ONLY BE USED WITHIN THE PREROGATIVES OF THE USER'S (DIVER'S) TRAININGS.

A NON-STANDARD USE AND/OR USE OF A TRITON® THAT IS NOT REGULARLY MAINTAINED IN ACCORDANCE WITH M3S GUIDELINES MAY RESULT IN PERSONAL INJURIES OR DEATH.

EACH USER MUST CARRY OUT THE MAINTENANCE OF ITS TRITON® IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.

IN ACCORDANCE WITH THE CHECKLIST, PRE-DIVE TESTS ARE ESSENTIAL BEFORE DIVING WITH A TRITON® UNIT IN ORDER TO CHECK THAT THE MACHINE WORKS PROPERLY.

THE TRITON® OXYGEN TANK MUST BE TESTED EVERY 2 YEARS, WITH AN ANNUAL INSPECTION.

EACH GAS USED FOR A TRITON® DIVE MUST BE PREPARED IN ADVANCE, CHECKED AND IDENTIFIED BEFORE EACH DIVE.

ONLY LUBRICANTS COMPATIBLE WITH OXYGEN MUST BE USED TO MAINTAIN THE MACHINE (SEE PARAGRAPH ON MAINTENANCE).

EACH CELL MUST NOT BE USED BEYOND 12 MONTHS AFTER ITS MANUFACTURING DATE.

REGARGE OF THE BATTERIES FOR THE PPO_2 DISPLAY AND THE NERD2 DECOMPRESSION COMPUTER (OPTIONAL) MUST BE DONE USING THE SUPPLIED CHARGERS.

IN THE EVENT OF THE MACHINE DROWNING, RETURN IT TO THE MANUFACTURER, AFTER RINSING AND DRYING FOR A FULL CHECK.

M3S DRAWS YOUR ATTENTION TO THE FACT THAT THE TRITON® IS A LIGHT REBREATHER, THUS EASY TO HANDLE BUT SUBJECT TO SEVERE IMPACTS. YOUR REBREATHER MUST THEREFORE BE HANDLED WITH CARE.

THE TRITON® IS GUARANTEED FOR 2 YEARS, CONFORMITY GUARANTY, EXCEPT FOR:

- DEFECTS IN MAINTENANCE OR USE (DROWNING, BREAKAGE, DAMAGES…),
- DAMAGES DUE TO INCORRECT HANDLING, ABUSIVE OR ABNORMAL USE (IMPACT ON THE LEDS, USE OF UNSUITABLE CHARGER — >1MAH), COMMERCIAL OR PROFESSIONAL USE (UNLESS AGREED OTHERWISE BY THE SELLER),
- TRANSPORTATION COSTS,
- PRODUCT MODIFICATION COSTS IN CASE OF A RECALL BY THE MANUFACTURER DUE TO A SERIAL DEFECT,
- DAMAGES CAUSED BY BAD WEATHER OR EXTERNAL EVENTS,

- **SPARE PARTS OR ACCESSORIES WHOSE REPLACEMENT RESULTS FROM NORMAL USE OR ROUTINE MAINTENANCE: BATTERY, SURFACE COATING, BROKEN GLASS, O-RING, OXYGEN CELLS…,**
- **PRODUCTS THAT HAVE BEEN MODIFIED BY THE USER,**
- **PRODUCTS SOLD SECOND-HAND OR IN A SALES DEPOT.**

WE ADVISE YOU TO TEST ALL NEW EQUIPMENT OR EQUIPMENT RETURNED FROM OVERHAUL, IN CASE IT SUFFERED TRANSPORTATION DAMAGES.

GENERAL INFORMATION

The TRITON® is a mix gas rebreather. It enables you to breath underwater. The regulation UE 2016/425 classifies the TRITON® as a category III (EPI) personal protective equipment preventing from the risk of mixed gas dangerous to health.

The scuba diving rebreather of mixed gas is a protective device against liquids (such as fresh water, seawater or pool water) designed for use in aquatic environment.

The TRITON® complies with the harmonized norm EN14143 : 2013. The notified body RINA n°0474 undertook the exam UE type. M3S therefore wrote a conformity declaration that you will find on the USB key supplied with your machine and which you can find on our website (https://www.ccrTRITON.com/telechargement-ccr-TRITON).

TECHNICAL SPECIFICATIONS

2.1. General Description

2.1.1 Overview

Le TRITON® is a closed mechanical chestmounted rebreather. It can be used in pure oxygen configuration or mCCR configuration.

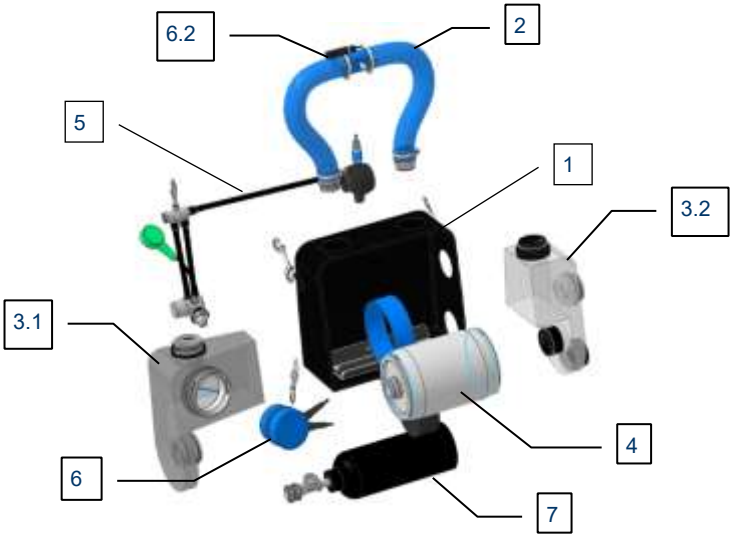


FIGURE 2.1 – TRITON® overview

TRITON® is made of:

1. A Kevlar® protective cover
2. A breathing hose including a DSV (Dive Surface Valve) and two ringed hoses
3.1. An inhale counterlung
3.2. An exhale counterlung
4. A canister
5. A gas line with an adjustable ADV (Automatic Diluent Valve)
6. A cells holder
6.1. A PpO_2 display
6.2. A HUD (Head Up Display)
6.3. An optional computer
7. An O_2 tank

These components are described under section 2.1.3.

2.1.2 Technical features

Overall size:

- Thickness: 16cm
- Height: 50cm
- width: 45cm

Weight:

- Ready to dive (standard configuration): 12kg
- Empty:7 kg
- Lime (axial scrubber): 2.2kg

Gas injection:

- O_2: M3S valve (constant mass flow) 0.7L/min in standard configuration
- Diluent: Injection by ADV

2.1.3 Components

The protective cover

The TRITON® mechanism is kept in a protective Kevlar® bag measuring 35x40x16cm. The face of the protective cover can be completely removed and changed. This allows full access to the various interior components, thus facilitating the installation. Faces are color interchangeable. They can also be personalized with embroidery. (If required, please contact M3S).

The protective cover has a handle on the back, making it easier to handle. The 4 corners of the protective Kevlar® cover are fitted with enders to secure the rebreather to the diver's stomach and ensure optimal comfort.

The bottom of the protective Kevlar® cover is fitted with a stainless steel holder and a strap to secure the oxygen tank.

FIGURE 2.2 – Dimensions of the protective cover

Furthermore, situated on the top rear of the protective cover there is a zip allowing the passage of the PpO_2 display, HUD and computer (optional).

The breathing loop

The breathing loop has ringed silicon hoses and a DSV. Please refer to section 4.2.4 for its maintenance and to section 4.3.2 for its overhaul.

Counterlungs

Counterlungs are made of coated cordura. Situated as close as possible to the diver, they provide a better breathing comfort.

There are 2 counterlungs and both are asymmetrical, an inhale one and an exhale one. In each counterlung, anti-collapse devices ensure the flow of the preferred gas.

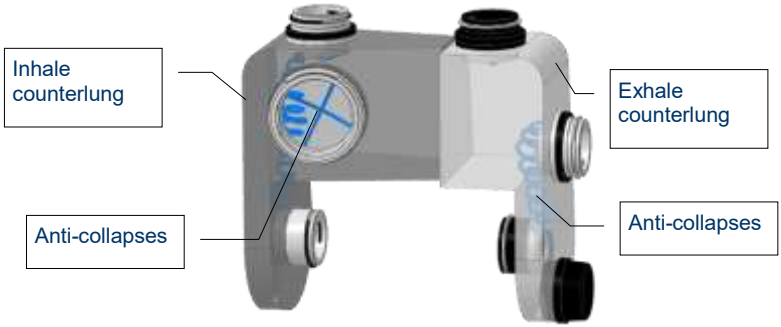
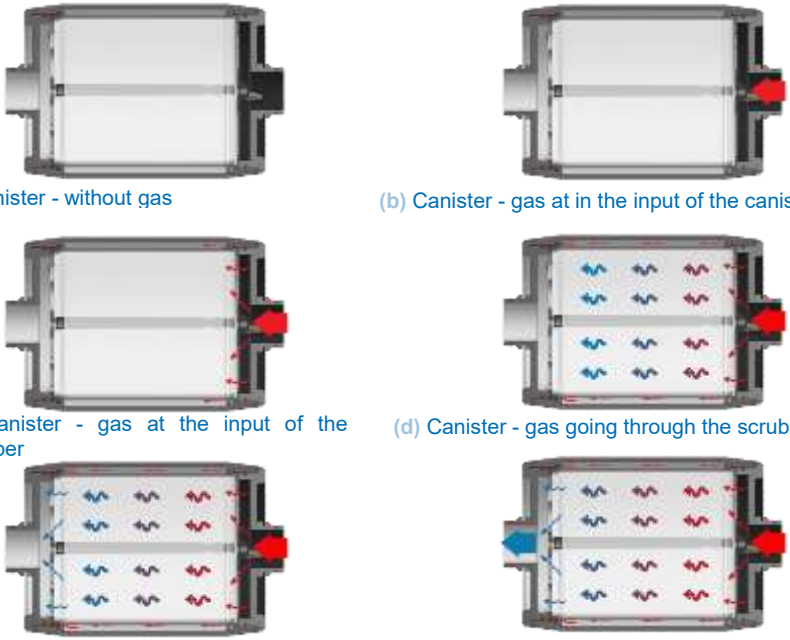


FIGURE 2.3 – Counterlungs overview

The canister

The TRITON® has a horizontally axial scrubber. Inside the canister, the scubber holds 2.2 kg of Sofnolime lime (consumable). Refer to section 2.2 (p**er**formance limitations) for time limitations.

Figure 2.4 shows the gas filtration process. Gas loaded with CO_2 are shown in red while “cleaned” gas, i.e. gas with a low CO_2 content, are shown in blue.



a) Canister - without gas

b) Canister - gas at in the input of the canister

c) Canister - gas at the input of the scrubber

d) Canister - gas going through the scrubber

e) Canister - gas going out the scrubber

f) Canister - gas going out the canister

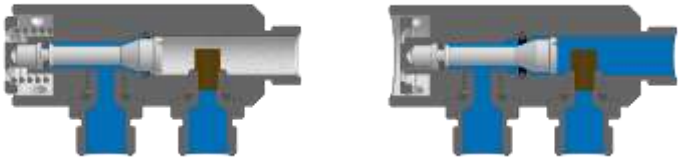
FIGURE 2.4 – Canister operation

Gas line

- **M3S valve**

The M3S valve is a mobile device (a valve) with a constant mass flow whose operation is illustrated in Fig. 2.5.

FIGURE 2.5 – M3S valve operation



(a) M3S valve closed (b) M3S valve opened

Opened valve, the diver activates the valve push button enabling the addition of oxygen (cf. figure 2.5.b). In its closed position, the flow automatically returns to 0,7L/min. (cf. figure 2.5.a).

- **MPC first stage**

The MPC first stage is a fixed intermediate pressure first stage, standardly fitted at 11,5bar. It is certified with norm EN 13 949: 2003 and EN 250: 2014.

During training, your instructor will check and adjust the settings.

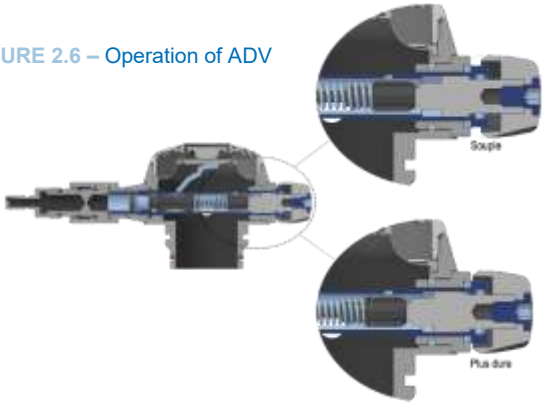
Regarding overhauls please refer to section 4.3.5.1.

- **ADV**

The ADV (Automatic Diluent Valve) enables to add diluent. It is set up on the exhale counterlung.

The ADV has a selector for the comfortable injection of diluent in the counterlung.

FIGURE 2.6 – Operation of ADV



Cells holder

The TRITON® masterpiece. Connected to the inhale counterlung, it contains 3 oxygen cells enabling the analysis of the PpO_2 inside the breathing circuit.

The cells holder also identifies the TRITON®.

PpO_2 Display

The PpO_2 display provides the analysis of the PpO_2 within the breathing circuit. In its standard configuration, the TRITON® is delivered with a PpO_2 display.

It controls a HUD and an alarm that react outside the set PpO_2 range.

HUD (Head Up Display)

The HUD relays information and alarms from the PpO_2 display.

The HUD is set to the breathing loop with its holder that can be positioned in accordance with the diver's wish.

Decompression computer (optional)

In its standard configuration, the TRITON® comes with a PpO_2 display and an optional decompression computer. Both components are directly connected to the cells holder.

Through the M3S after sales service, it is possible to add an optional computer to the standard TRITON® configuration with a PpO_2 display only. It is also possible to have the optional computer changed.

Oxygen tank

In its standard configuration, the TRITON® is equipped with a 1.5L/230 bar aluminum tank or with a 2.5L/200 bar steel tank. All tanks used are oxygen compatible. Therefore, they must only contain pure oxygen (the same applies to the valve and the first stage).

The oxygen tank complies with the standard regulations and certification bodies, this means that it must be inspected and tested in accordance with the current local regulations.

2.2 Limitations and performances

The TRITON® limitations and performances depend on the configuration in which it is used as well as on the diluent used.

The manufacturer takes the liberty to remind that no one is supposed to dive outside its prerogatives or if they are not in good physical conditions (good health, good shape …).

General limitations

Diving with a rebreather requires to pay attention to the PpO_2. Recommended values are:

TABLE 2.1 – PpO_2 corresponding to the depth range

Depth (in m)	Diving	Recommended PpO_2 (in bar)
0 - 6	Begining and end of dive	0.9 - 1.6
6 - 100	dive	1.1 - 1.4
6 - 100	decompression	1.3 - 1.6

It is important to remember that the diver must limit both his descent and ascent speed in order to:

- Allow the ADV to play his role,
- Control the PpO_2 during those two phases.

Depth limits

The table 2.2 shows the possible depth limits according to the rebreather configuration.

TABLE 2.2 – TRITON® depth use according to its configuration

Maximum depth (en m)	Configuration
6	Pure oxygen
40	Air diluent
100	trimix ou heliox diluent

Duration limits

The diving duration might be limited by two factors, mainly: the amount of gas available and the scrubber endurance.

- **Amount of gas available:**

When diving with a closed circuit, the amount of remaining gas is rarely a limitation in itself. Nevertheless, it is necessary to check the content of the oxygen tanks and diluent. It is possible to connect an external gas source if necessary.

- **The scrubber endurance:**

The endurance of the absorbent scrubber has been tested under CE[1] conditions for 2.2kg of

[1] depth : 40m, flow : 40L/min, temperature : 4°C, humidity: 80%, and a production of 1.6L/min of CO_2

SOFNOLIME Lime.

These values are theoretical and highly depend on the dive (water temperature, diver's physiology, physical activity …). It is therefore dangerous to exceed the recommended duration.

The CO_2 filtration process is an exothermic chemical reaction. It is therefore subject to current temperature.

Moreover, lime never really stops working. Extended surface intervals are therefore non-neglectable.

For this reason, it is important to store lime away from all environment changes.

The use of the lime requires a training and is based on the manufacturer' recommendations.

TABLE 2.3 – CO_2 scrubber endurance according to depth under CE conditions.

Temperature (en °C)	depth (en m)	duration
4	6	135min (2h15)
4	40	75min
14	100	60min

- **Energetic endurance:**

The PpO_2 display has an autonomy of 10h in its standard configuration. It is important to ensure that it is charged before the scheduled dive.

Temperature limitations

The TRITON® is designed to operate under temperatures between 4°C to 34°C.

2.3 TRITON® identification

Each TRITON® has its proper serial number. This number can been found on the cells holder as follows:

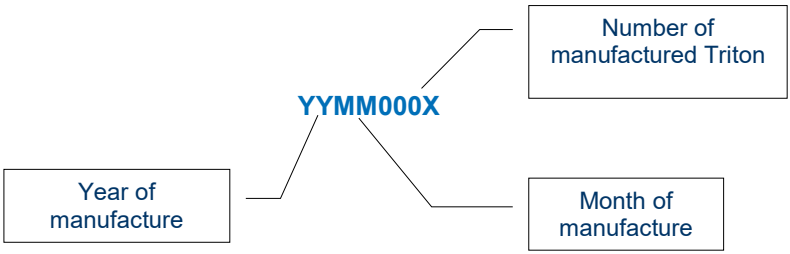


FIGURE 2.7 – Serial number explanation

OPERATING INSTRUCTIONS

First dives must be done with a certified TRITON® instructor. Assembly, disassembly and maintenance of the machine must be explained and shown in details by the instructor.

3.1 Assembly

The assembly of the TRITON® is the first thing to do before being able to use it. Generally speaking, it is carried out as follows:

- Electronics
- Canister
- Counterlungs
- Loop
- Gas line with tank
- Kevlar® protective cover

On our website, you can find a checklist. It helps you to assemble your TRITON®.

Once the TRITON® has been assembled, a series of tests is carried out to check that the unit operates properly :

- Positive test
- Negative test

The rebreather tests are one of the most important step and is therefore described in a separate chapter (refer to section 3.2).

3.1.1 Electronics

3.1.1.1 PpO_2 Display

The PpO_2 display has its own notice. For its correct operation, please refer to this notice.

3.1.1.2. Cells

The TRITON® has 3 oxygen cells. The cell is an important component of the rebreather. It allows the measure of the oxygen partial pressure in the breathing circuit.

The partial pressure is given by the voltage of sensor's reaction (oxygen reaction).The nominal voltage should be between 9-13mV in air at sea level.

Those sensors are sensitive to humidity and to high temperatures. Although the manufacturing of those cells is optimized for a rebreather use, water drops on exchange surface prevent from working properly. In case of drowning your rebreather, please go to section 4.1.1. Refer to section 5.1 for storage instructions.

On each cell, there is a label showing its manufacturing date.

FIGURE 3.1 – M3S oxygen cells with manufacturing date.

M3S recommends the replacement the cells within 12 months from the date of its manufacture (YYYY-MM — year-month). Over time, the cell gets old and do not operate properly. They move away from their nominal voltage. The partial pressure cannot be properly measured.

Warning:

The cell contains chemical components (galvnic sensor). This sensor is perishable. Failure to change a cell old more than 12 months exposes the TRITON® male and female cells' connectors to oxidation risk.

Refer to section 4.2.1 for replacement if necessary.

3.1.1.3 Oxygen tank analysis

The analysis of oxygen tank ensure that it is correctly filled with pure oxygen.

3.1.1.4 Calibration

Calibration is essential for the proper operation of the rebreather. It is used to calibrate the measure of the 3 cells through the PpO_2 and the decompression computer (optional). This is why a daily calibration is recommended. For calibration instructions, please refer to section 3.3.4.

Recommendation:

A cell must not be used beyond12 months from its manufacturing date.

3.1.1.4 Veracity test

The nominal operating voltage should be between 9-13Mv in the air at sea level. We remind you that over time, this voltage differs from its nominal value. This is why it is necessary to check the accuracy of the cell voltage. The veracity of the cell voltage is done through the PpO_2 display. Please refer to its notice.

Warning: It is essential to check the nominal voltage

A calibrated cell displaying 1.6bar oxygen at 6m does not necessarily indicate the correct PpO_2 at 40m or 100m. This exposes the divers to a risk of accident or decompression.

3.1.2 Canister

3.1.2.1 Filling the lime scrubber

M3S recommends to use the soda lime SOFNOLIME 797 grade mesh 1.0-2.5mm.

Recommendation:

The filling of the lime scrubber must be done in a dry and well-ventilated area. We also recommend you to watch out for dust when you get at the end of the canister.

To fill the scrubber, please proceed as follows:

1. Remove the scrubber from the canister.
2. **Properly position the 'hydrophobic' scrubber at the bottom of the scrubber**. This scrubber is the biggest of the two scrubbers.

The hydrophobic scrubber allows:

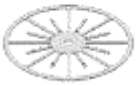
- To retain dust in the lime scrubber.
- By its hydrophobic nature, to delay the entry of water. Indeed, liquids are detrimental to soda lime and affect its operation.

3. **Fill the scrubber with lime to the limit;**
4. **Tap the scrubber for at least 1 minute** to place the lime;

FIGURE 3.2 – Installation of the hydrophobic scrubbers

FIGURE 3.3 – Canister scrubber filling

5. **Add** lime to the limit;
6. Repeat these last two steps until the scrubber is full;
7. Set the second hydrophobic scrubber together with the grid. This scrubber is the smallest of the 2 scrubbers;



8. **Screw the wingnut;**
9. Check the bottom of the scrubber for any empty space.

FIGURE 3.4 – Set up of the grid on the canister scrubber

3.1.2.2 Canister verification:

The verification of the canister consists in:

- Check the integrity of the white and black flanges,
- Check the integrity, cleanliness, lubrification and position of the 2 O-ring's scrubber. They are situated at the bottom of the canister, on the white flange, as follows,
  - The red O-ring (silicon) on the white flange,
  - The black O-ring (EPDM) in the canister groove.

FIGURE 3.5 – Canister O-rings

3.1.2.3 Closing the canister

Once the scrubber is filled in and the verification of the canister done, insert de scrubber in the canister and close it using the plastic locking ring.

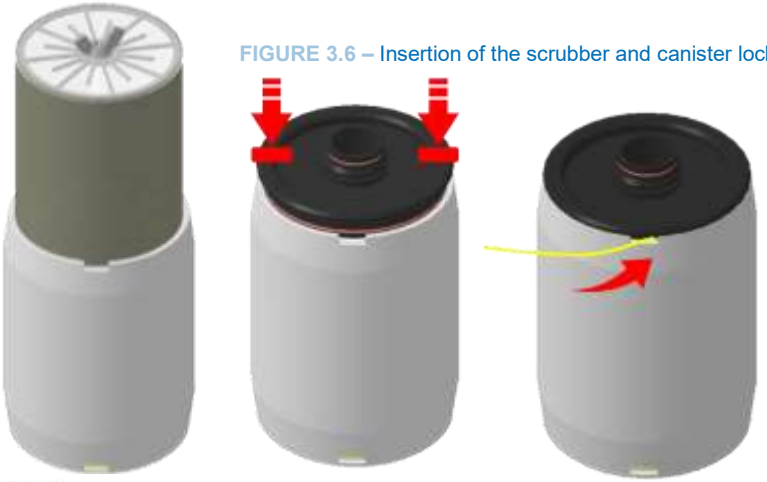


FIGURE 3.6 – Insertion of the scrubber and canister lock

After closing the canister, use the tape supplied to indicate the following information:

- Name of the canister's owner
- Filling date.

As you dive, keep track of usage times (section 5.1).

FIGURE 3.7 – Use of the diving time tape

3.1.3 Counterlungs

3.1.3.1 Counterlungs check

Before assembling the counterlungs to the canister, please check the anti-collapse integrity. These must not be detached from the connections.

3.1.3.2 Connection to the canister

Warning:

In case of breakage or disassembly of the anti-collapses, do not dive as it may flood the rebreather. Contact our after sales service.

The TRITON® has mechanical coding such as size and color to facilitate the assembly. The color coding is as follows:

WHITE PARTS	INHALE COMPONENTS
BLACK PARTS	EXHALE COMPONENTS

It is understood that a male connection of one color clips onto the same color connection. Otherwise, the connection is impossible or is not waterproof as shown on figure 3.8.

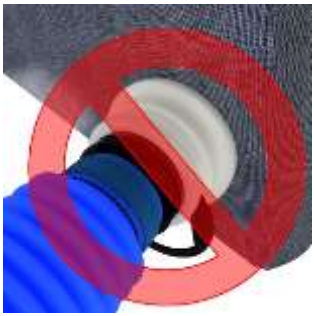
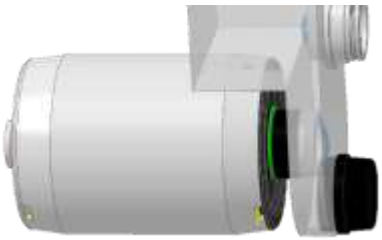


FIGURE 3.8 – Attempt to exchange connections impossible

FIGURE 3.9 – Assembly of the exhale counterlung



The assembly of the counterlung onto the canister is as follows:

- Connect the exhale counterlung to the canister. The black connection of the canister tap on the black connection of the exhale counterlung.
- Position the white clip to secure the assembly.

Connect the inhale counterlung to the canister. The white connection of the canister tap on the white connection of the inhale counterlung.

Position the black clip to secure the assembly.

FIGURE 3.10 – Assembly of the inhale counterlung

Warning:

Clips must be fully inserted to ensure a secured connection.

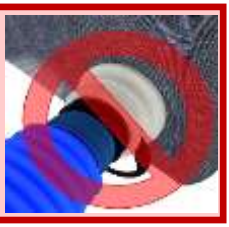


FIGURE 3.11 – Attempt to exchange connections impossible

Insert in the protective cover the canister assembly together with the 2 counterlungs. The canister must be tightly held onto the canister holder by the blue scratch.

FIGURE 3.12 – Installation of the canister and counterlungs in the protective cover.

FIGURE 3.13 – Securing counterlungs.

Position the exhaust valve in the orifice and the 3 clamp rings to secure the connections on the protective cover.

3.1.3.3 Electronics connection

Insert the cells holder in the inhale counterlung.

Insert the display, HUD and decompression computer (optional) in one of the rear openings of the cover. The position of the HUD and the head up decompression computer (optional) will be done once the loop is fitted.

FIGURE 3.14 – Electronics connection to the inhale counterlung

Warning:

Cables must not wrap around counterlungs.

3.1.4 The loop

Once the canister is filled, tested, connected to the counterlungs and inserted in the cover, it is then possible to start the assembly of the loop itself.

Of course, before the assembly of the loop, the user must ensure that all parts together with the O-

Recommendation:

M3s recommends to check that there are no unwanted hosts, such as slugs, in the rebreather. Indeed these can seriously impair the rebreather's operation.

rings are in perfect conditions, lubricated with an oxygen compatible lubricant only

3.1.4.1 Breathing hose tests

The breathing hose tests consist in an overpressure test, depression test, gas flow test and a mouthpiece check.

Overpressure test:

1. Plug the hose output with the hand on the black connection side.
2. Blow in the mouthpiece.

Air **must not be able** to flow.

FIGURE 3.15 – Loop assembly overpressure test.

Depression test :

1. Plug the hose input with the hand on the white connection side.
2. Inhale through the mouthpiece.

Air **must not be able** to flow.

Gas flow test:

1. Leave the input and output of the hose clear (black connection).
2. Inhale and blow through the mouthpiece.

Air **should be able** to flow.

Visual verification of the mouthpiece

1. Check the state of the mouthpiece.
2. Check the mouthpiece fitting.

FIGURE 3.16 – Loop assembly and depression

Recommendation:

M3S reminds that the certification pressure is +/- 25m bar. The mushroom check must not be an inhale and exhale breathing at maximum human pressures.

3.1.4.2 Loop connection

Engage the inhale male connection (white) of the breathing hose onto the female inhale connection (white) of the protective cover.

Engage the clip in its closed position to lock the connection.

Engage the exhale male connection (black) of the breathing hose onto the female exhale connection (black) of the protective cover.

Engage the clip in its closed position to lock the connection.

FIGURE 3.17 – Loop connection.

Fix the HUD holder onto the DSV last two rings on either the right or the left.

Set the HUD onto the HUD holder and position the cable on the hooks alongside the breathing hose.

Set the decompression computer head up (optional) on the other side of the DSV beside the HUD, and attach the cable onto the hooks.

3.1.5 Gas line

3.1.5.1 ADV Assembly

Engage the ADV in its female connection.

Push the clip in its closed position to fasten.

Hook the line ender on to the second ring on the right inside of the protective cover.

FIGURE 3.18 – Connecting and securing the ADV.

3.1.5.2 Assembly of the oxygen tank

The tank valve is always on the right inside of the TRITON®. Set the tank against the tank holder. It is secured by the strap.

Screw the MPC 1st stage onto the oxygen tank, strapped under the TRITON®.

Recommendation:
When the regulator is not screwed to the valve, put the plug supplied with it.

The TRITON® is assembled, the positioning and the closure of the front panel is then possible.

Recommendation:
Tanks must be hydrostatic tested every 2 years.

FIGURE 3.19 – Tank assembly.

3.2 Tests machine

Warning:
Before any dive, whether in a closed or opened circuit, it is essential to test the tank pressure and analyze the gas.

Even if the tests are correct when assembly, it is important to repeat them before diving. Indeed, during transportation, the rebreather may suffer from damages or maladjustments. This can have serious consequences when diving.

Recommendation:
Repeat the negative test after its last handling before diving

Two tests are necessary and essential before any dive. It is important to carry them out in the order described hereunder. The advantage of this order is:

1. The overpressure test is done first to ensure that O-rings and connections are properly in place.
2. The depression test enables to detect «entering» leaks in the loop.

These tests are described in details below.

3.2.1 Overpressure test

The overpressure test (like the depression test) is used to detect leaks. The rebreather cannot operate properly in the event of a leak, it is therefore important to detect them.

The rebreather must be fully assembled to be in a « diving » configuration, and the exhale exhaust valve hardened to the maximum. The overpressure test is performed with a closed tank and an open Kevlar® cover in order to watch what happens in the rebreather.

The aim of this procedure is to fill the TRITON® with as much air as possible and see whether there are air losses and if cables hinder the counterlungs.

The user must have the mouthpiece in the mouth with the DSV open.

Inhale through the nose then exhale through the mouth several times until the exhaust valve release itself and then close the DSV.

Observe the counterlungs and ringed hoses (the reabreather flexible parts) and watch for a possible change due **to losses**.

This test must last at least one minute.

If these two elements are not satisfactory, it means that there are leaks. One must find where they come from. Leaks might come from[2]:

- Incorrect assembly
- One or several defective O-rings
- One or several elements stuck in a

FIGURE 3.20 – Visualisation of the TRITON® under an overpressure test

[2] non-exhaustive list

junction (residual lime, small stones, slugs or other)
- One or several defective parts

It can be useful to dissassemble and reassassemble the rebreather to find the leak(s). A spray of soapy water or a basin full of water can help in finding the leaks thanks to bubbles.

3.2.2 Depression test

The depression test (like the overpressure test) is used to detect leaks. The rebreather cannot operate properly in the event of a leak, it is therefore important to detect them.

The rebreather must be fully assembled to be in a « diving » configuration, and the ADV flowstop and the tank in a closed position. This test is performed with an open Kevlar® cover in order to watch what happens in the rebreather.

M3S recommends to put the TRITON® on its box to carry out this test.

The aim of this procedure is to empty the TRITON® from its air as much as possible and see whether there are air infiltrations.

The user must have the mouthpiece in the mouth with the DSV open.

Inhale through the mouth then **exhale** through the nose several times until the collapse of the counterlungs This may require a thoracic effort to empty the TRITON® as much as possible. On the last **inhale**, close the DSV.

FIGURE 3.21 – Visualisation of the TRITON® under dépression test.

Observe the counterlungs and ringed hoses (the reabreather flexible parts) and watch for a possible change due to the filling of the loop. This test must last at least one minute.

If these two elements are not satisfactory, it means that there are leaks. Please refer to section 3.2.1.

3.3 TRITON® assembly flow chart

Figure 3.22 summarises the TRITON® assembly and testing steps in the form of a flow chart

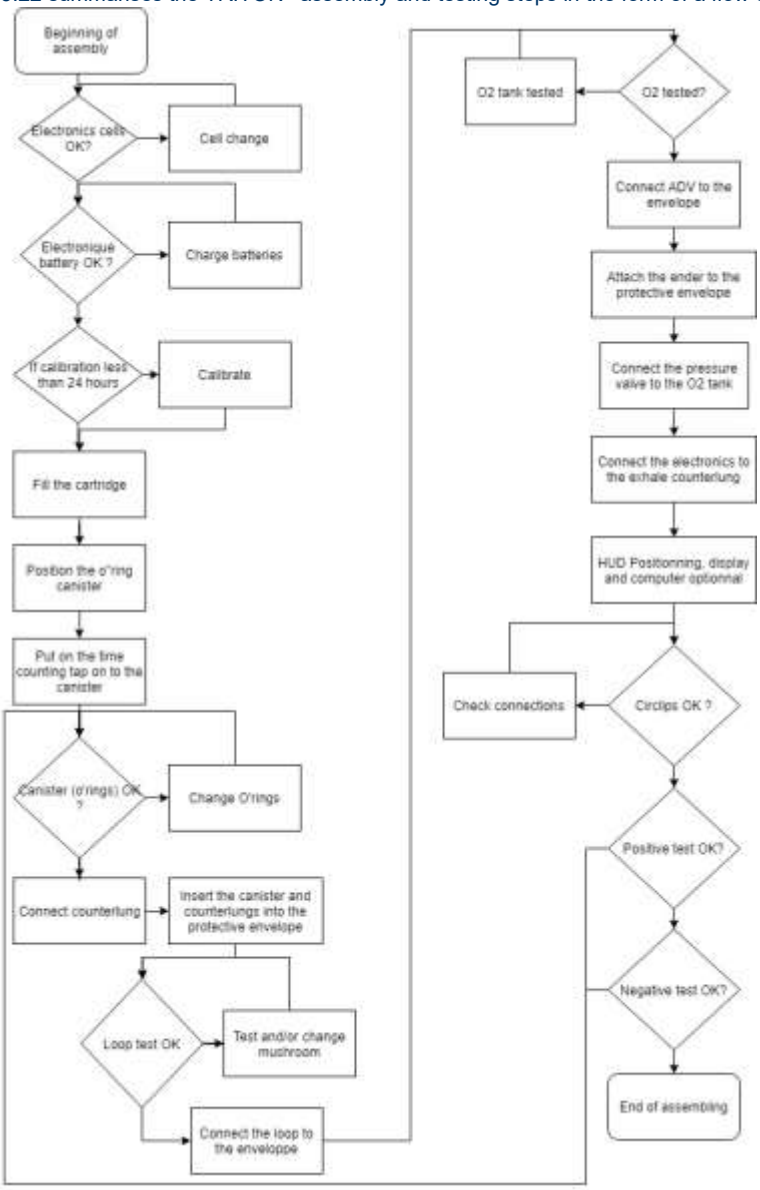


FIGURE 3.22 – Flow chart of the tests to be undertaken on the TRITON® before each dive.

3.4 Settings

The possible settings are as follows: positionnning the TRITON® on the diver, M3S valve flow, ADV sensitivity and cells calibration.

To optimize the rebreather comfort, few settings need be done to adapt the TRITON® to your morphology.

Your instructor trainer is required to help you in setting your TRITON®.

3.4.1 TRITON® adjustment

3.4.1.1 The harness

The harness must have 2 shoulder rings for the upper attachment and 2 waist rings for the lower attachment. These rings must guarantee the TRITON® proper operation as shown in figure 3.23.

Recommendation:

We recommend the use of the harness with a crotch strape.

3.4.1.2 Positionning

As a chestmounted rebreather, the TRITON® can be used with a bailout in a standard configuration (on the back) or in sidemount. It is therefore necessary to adapt the used harness to fix the TRITON®.

The TRITON® has 4 snaps, which enable it to perfectly fit to the thoracic cavity of the diver. However, for an optimum breathing comfort, it must properly be positioned on the diver.

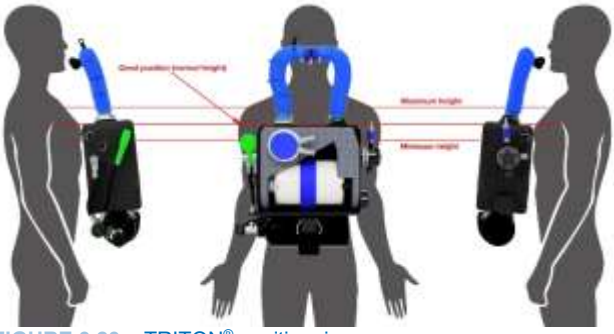


FIGURE 3.23 – TRITON® positionning

Definition of the correct height for the TRITON®: when the diver is outside the water and standing upright, the TRITON® must be attached a fist below the base of the neck. The upper part of the TRITON® must not be under the sternum.

3.4.2 M3S valve

The TRITON® is supplied with a M3S valve set to a flow rate of 0.7L/min. This corresponds to an average metabolic consumption. Each human being is different, it is possible to regulate this flow to gain in comfort. The valve flow rate is set with the average pressure of the MPC regulator.

This should be done with your instructor trainer when training.

The flow rate of 0.7L/min corresponds to an average pressure of the MPC between 11 and 12 bar (with a valve orifice of 33µ"). An estimated flow test can be done with a stopwatch:

- Gas line on an O_2 tank,
- Open the valve
- Allow pressure to rise beyond 150 bar
- Close the valve again

- Time the passage from 150 bar to 100 bar

Using the following graph, you can estimate the flow rate of your M3S valve.

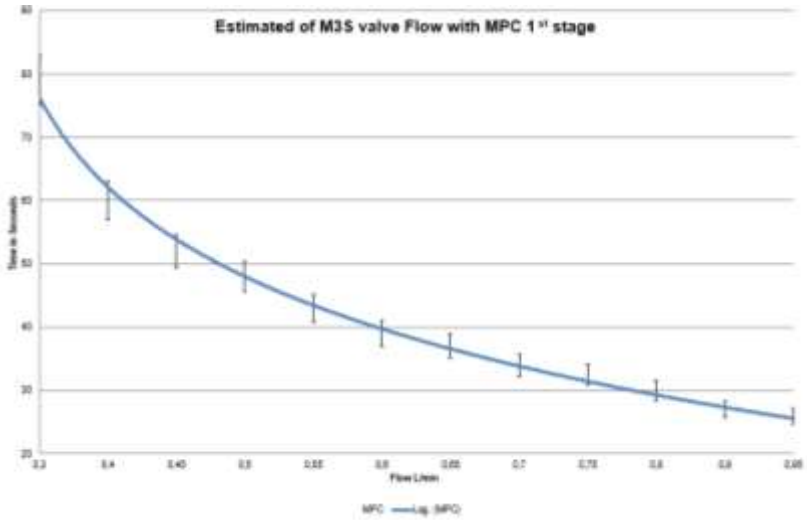


FIGURE 3.24 – Time running from 150 to 100 bar

3.4.3 ADV

The TRITON® ADV is adjustable. The wheel allows to precisely set the flexibility of the diluent injection. The average regulator pressure must be between 8 to 8.5 bar for optimum ADV performances.

Warning:
If you are not using the DS hose supplied with the TRITON®, both the Direct System hose and the DS ADV adaptor must be tested and validated.

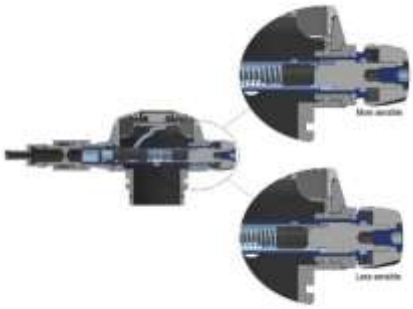


FIGURE 3.25 – ADV set up

This setting remains available throughout the dive and can be adjusted at any time.

3.4.4 Oxygen cells calibration

When diving, having only the onboard gas quantity information in real time is not enough. It is necessary to have qualitative information on the gas contained in the loop. It is therefore essential to have oxygen cells properly calibrated so that they give reliable information during the dive

Cells calibration

The calibration procedure is as follows:

1. Fully assemble the TRITON®,
2. Completely rinse the TRITON® 3 times with pure oxygen,
3. Close the DSV and open the exhaust valve,
4. Switch on the PpO_2 display,
5. Check altitude,
6. Choose the "OXYGEN 98%" calibration,
7. Calibrate (please refer to the display notice),
8. Check that cells voltage are above 40mV then confirm calibration.

Fine calibration

When calibrating the oxygen cells with the fully assembled TRITON®, non circulating gas remain in the loop. Calibration is slightly distorted. It is possible to make a fine calibration without any tools.

The process to carry out this calibration is as follows:

FIGURE 3.26 – setting up fine calibration

1. Disconnect the inhale counterlung from the scrubber (if needed),
2. Disconnect the ADV from the exhale counterlung (if needed),
3. Push the ADV into the inhale counterlung connection,
4. Empty the circuit with the mouth and close the DSV,
5. Inject oxygen (no overpressure risks from the cover(s)),
6. Switch on the PpO_2 display,
7. Choose "OXYGEN 99%" calibration,
8. Calibrate (refer to the display notice),
9. Check that cells voltage are above 40mV then confirm calibration.

FIGURE 3.27 – Fine calibration verification

3.5 Pre-dive and diving tests

3.5.1 Pre-dive test

Waterproof tests

- No handling that might create impact since the last negative test,
- Last negative test satisfactory.

Electronics

- Check that the PpO_2 display is correctly charged,
- Check that the autonomy of the decompression computer (optional) is sufficient,
- Check that the settings of the decompression computer are correct (optional).

Lime

- Canister with new lime or in case of successive dive a sufficient quantity for the dives,
- Labelled lime Canister.

Oxygen tank

- Analysis and labelling of the oxygen tank,
- Checking tank pressure>100bar.

Oxygen Valve

- Functional manual injection check,
- Correct constant flow (after closing the oxygen tank loss of 10 bar in about 7sc))

Diluent bottle

- Analysis and labelling of the diluent bottle,
- Checking tank pressure>100bar.

ADV

- Connection of the diluent bottle to the ADV
- ADV operating test
- Check there is no constant flow
- Check manual addition
- Closure of the ADV flowstop

Source of buoyancy

- Direct-System connection
- Inflator operating test
- Exhaust valve operating tests
- Check lack of leaks from the buoyancy source

Equipment

- Decompression computer correctly set,
- Sufficient decompression computer autonomy,
- Sufficient bailout for the dive,
- Security equipment suited for diving.

3.5.2 Pre-dive surface

Pre-dive breathing

- Check that the rebreather is secured to the harness and is well positioned,
- Check that the PpO_2 display and the decompression computer turned themselves on properly (optional),
- Opening of the oxygen tank,
- Check cells operation (dynamic PpO_2 in breathing stage),
- Oxygen rinsing PpO_2 >0.9 bar,
- Validation of the team checks.

3.5.3 The dive

Throughout the dive, you have to know your PpO_2, and should never hesitate in applying the safety procedures taught by your instructor trainer during your TRITON® training courses.

Zone 0–6 m

- PpO_2 control> 0.9bar,
- The aimed PpO_2 must be between 0.9 and 1.6 in the 0–6m zone,
- Stabilization at 6m for a team bubble check,
- At the beginning of the dive, opening of the ADV flowstop at 6m,
- ADV operating test,
- At the end of the dive, closure of the ADV flowstop and Oxygen rinse at 6m.

Zone 6–100m

- Control of the descent,
- Stabilization at the aimed depth,
- Adjust the ADV sensibility with the adjusting wheel to breathe on minimum loop volume
- Buoyancy control when ascenting,
- Keep breathing on minimum loop volume.

Recommendation:

In case of a decompression diving, M3S recommends to have a target PpO_2 between 1.4 and 1.6 during the decompression stops.

MAINTENANCE INSTRUCTIONS

This chapter is about the daily and more in depth maintenance of the TRITON®.

Recommendation:

Between 2 successive dives on the same day, M3S recommends the aeration of the TRITON® by disconnecting the cell holder from the inhale counterlung in order to prevent from residual humidity.

4.1 Cleaning

4.1.1 Rinsing

After each dive, the TRITON® must be fully opened, dried and eventually emptied of any water it may contains.

The breathing loop and the counterlungs must be rinsed with clear water to remove condensation and residual saliva. These parts should be disinfected on a regular basis (refer to section 4.1.2)

Warning, one must not forget to detach the electronics including the cells holder before rinsing the inhale counterlung. To do this, you require to:

- Open the TRITON® protective cover to gain access to the interior,
- Disconnect the cells holder from its holder and the cables from the clips.
- Remove electronics from the protective cover (cells holder, HUD and display...).

Warning: If the rebreather has been flooded

In case of improper use or bad assembly, the rebreather may be flooded during the dive. The mix of soda lime and water produces a basic liquid (pH≈9). It is therefore necessary to clear the rebreather thoroughly to avoid damages to the unit and to the diver the next time.

Special care must be taken with electronics.

The procedure to adopt in case of drowning is as follows:

1. Clean the entire unit with clear water.
2. Air dry the unit and the electronics.
3. Return the unit to the manufacturer.

4.1.2 Disinfection

The breathing loop and the counterlungs also act as saliva receptacle. In the long term, they are thus exposed to germs and bacterias. The rebreather being a warm and humid environment, it is favorable to the development of micro-organisms. It is therefore essential to regularly disinfect the breathing loop and the counterlungs.
The products used must not be harmful to the unit or to the diver's health. A non-exhaustive list of recommended products is given below:

- Chemgene HLD4L
- Virkon S
- Steramine 1G

Please follow the laboratory's directives to use these disinfectants.

4.1.3 Drying

Whether it is a simple rinse or a complete disinfection of the unit, we draw your attention on the importance of the drying quality.

The drying of the unit after each use must be done in a well-ventilated area. When drying, the user needs to pay attention and avoid any potential water retention in each of the TRITON® parts (for example, counterlungs).

Cells must be ventilated to operate properly. The cells holder needs to be detached from the inhale counterlung to enable the ventilation of the cells.

M3S recommends to dry the gas line by hooking it using the snap.

Warning:
The drying of the unit and its parts must not be done under the sun.

4.2 Maintenance

A Regular maintenance is essential for the unit to work properly. This includes a number of checkpoints, such as for O-rings and cells.

Maintenance	Recommendation
O_2 cells replacement	Every 12 months whether used or not
O-rings	Every 12 months whether used or not
Hydrophobic scrubbers replacement	Every 12 months of use
Oxygen tank retest	Every 24 months
Visual inspection of the tank	Every 12 months
Maintenance pressure valve	Every 12 months
1st stage maintenance	Every 12 months
ADV maintenance	Every 12 months
Valve maintenance	Every 12 months
Hoses replacement	Every 36 months
Breathing replacement	Every 48 months
Display battery replacement	Every 36 months
DSV maintenance (user level)	Every 6 months
Mushroom replacement	Every 36 months
Counterlung replacement	Every 36 months of use
Over pressure valve replacement	Every 36 months of use

Warning:
The recommendations given are only for guidance. It is essential to store the unit in a dry place, away from lights and UV rays and well ventilated to avoid premature wear.

4.2.1 Oxygen cell change

Reminder, cells are wear parts. M3S recommends their systematic replacement 12 months from the date of their manufacturing (as indicated on the left of the bar code on the cell).

FIGURE 4.1 – Cell label with a date of manufacture

After each calibration and before each dive, it is essential to validate the veracity of the cells. This is done according to the procedure described in 3.4.4.

Recommendation:

Cells must be replaced when they are out of range, when they are below 42mV and 60mV at pure O_2 in the CNTP.

The replacement of the cells is as follows:

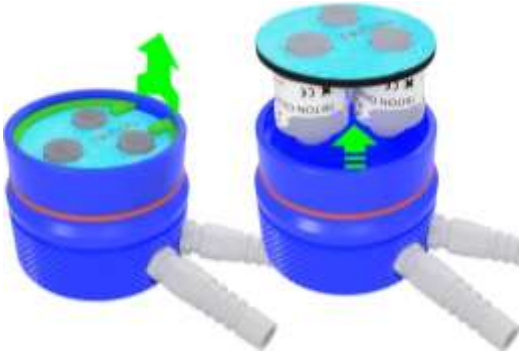


FIGURE 4.2 – Disassembly of cell support.

- Remove the cells holder from the inhale counterlung;
- Remove the inner clip from the cells holder;
- Remove the cells holder;
- Disconnect Cell 1 (if necessary);
- Disconnect cell 2 (if necessary);
- Disconnect cell 3 (if necessary);
- Replace the cell(s) by unscrewing them from the cell carrier plate;
- Remove the new O-ring from the new cells before screwing them back on to the cell carrier;
- Reconnect the cells ;
- Refit the cell carrier in the cells holder and secure it with a clip;
- Reconnect the cells holder to the counterlung to do a calibration.

4.2.2 Replacement of the O-rings

O-rings must be regularly lubricated with a lubricant « oxygen compatible ».

There are 5 differents sizes on O-rings on the TRITON®:

Recommendation:

M3S recommends to replace all O-rings every 12 months, whether used or not.

- 5 red connection O-rings, 2 on the loop, 2 on the canister, and 1 on the ADV
- 3 red canister O-rings, 2 on the canister tap, 1 inside.
- 1 red cells holder O-ring,
- 1 inner black O-ring for the canister,
- 1 black O-ring for the DSV screw.

The user can buy all these O-rings and the recommended lubricant from the M3S online shop (section 6).

4.2.3 Counterlungs replacement

Counterlungs may have to be replaced in case of damages, holes, tears.

Recommendation:

M3S recommends to replace the counterlungs every 2 years.

The user can purchase complete counterlungs from the M3S online shop (section 6) or return them for a liner change.

4.2.4 Loop and DSV maintenance

The DSV must be properly rinsed after each dive. However, it should be thoroughly serviced every 6 months.

Disassembling:

- Open the mouthpiece;
- Unscrew the hose clamps from the ringed hoses;
- Remove the ringed hoses;
- Delicately remove the mushroom holder from each side;
- Unscrew the DSV lever from the inside (using a screwdriver);
- Undo the stainless circlips with a lock ring plier;
- Slide out the inside black barrel completely;
- Carefully wipe the barrel and the inside of the DSV body.

FIGURE 4.3 – Dissambling the DSV from the loop.

Maintenance:

- Check the state of the barrel surface and of the DSV body. In the event of scratches, replace the two parts;
- Apply a thin layer of lubricant on the outside of the barrel and inside the DSV body;

FIGURE 4.4 – Dissambling of the DSV from the loop.

- Check the O-ring of the DSV screw and if necessary, replace it;
- If necessary, replace mushrooms.

Recommendation:

M3S recommends to replace the mushroom every 3 years or as soon as their joint plane is out of alignment.

FIGURE 4.5 – Dissambling of the DSV from the loop.

Reassembly:

- Apply pressure on the barrel to facilitate its insertion in the DSV body;
- Insert the barrel following the gas flow. Ensure well positioning (hole for the operating lever, evacuation light).
- Screw the DSV axis making sure it is waterproof (O-ring on the screw);
- Fix the stainless steel circlips with a flat plier;
- Position mushroom seats;
- Fix the ringed hoses on the DSV body (care must be given to the direction: inhale and exhale);
- Screw the stainless steel clamps at 120cN.m;
- Check that it is well operating and that is it waterproof (refer to section 3.2 for tests to be carried out).

4.3 Overhaul

Each return to the manufacturer has to be scheduled. In order to schedule the after sales of your TRITON®, please fill in the form available on our website as follows: https://www.ccrTRITON.com/contact-7.

Warning:

Each overhaul must take place at M3S.

A complete annual overhaul of the TRITON® is recommended.

This operation consists in the realization of all overhauls described below, a check, cleansing, diagnosis of the complete rebreather TRITON®, replacement of the parts specified in the maintenance plan and if necessary replacement of defective parts.

Warning:

Return your TRITON® to the manufacturer (section 5.2.2) for a complete overhaul every year.

An additional one-year warranty on your TRITON® is offered if all the mentioned overhauls are realized.

4.3.1 Protective cover overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, diagnosis and replacement of all necessary parts.

4.3.2 Overhaul loop

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, diagnosis, replacement of O-rings every 12 months, ringed hoses and mushrooms every 36 months in accordance to the maintenance plan, check of the DSV and if necessary, replacement of the defective parts.

4.3.3 Counterlungs overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, diagnosis, replacement of the overpressure valve every 24 months and of the linen (counterlungs) every 36 months in accordance to the maintenance plan and if necessary replacement of the defective parts.

4.3.4 Canister overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, diagnosis, replacement of O-rings and hydrophobic membranes every 12 months in accordance to the maintenance plan and if necessary replacement of the defective parts.

4.3.5 Gas line overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a MPC, valve, ADV overhaul and a replacement of hoses every 36 months in accordance to the maintenance plan and if necessary replacement of the defective parts.

4.3.5.1 MPC overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, degreasing, diagnosis, replacement of O-rings every 12 months in accordance to the maintenance plan and if necessary replacement of the defective parts and MPC settings.

Warning:
A leaking over pressure valve means that the MPC needs to be serviced. The valve cannot go out of adjustment.

4.3.5.2 Valve overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, degreasing, diagnosis, replacement of O-rings every 12 months in accordance to the maintenance plan and if necessary replacement of the defective parts and set up of the valve.

4.3.5.3 ADV, swivel and flowstop overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, degreasing, diagnosis, replacement of O-rings every 12 month in accordance to the maintenance plan and if necessary replacement of the defective parts and set up of the ADV.

4.3.6 Electronics overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, degreasing, diagnosis, replacement of the cells every 12 month, of the battery every 24 months in accordance to the maintenance plan and if necessary replacement of the defective parts.

4.3.7 Tank overhaul

This overhaul is included in the complete annual overhaul of the unit.

This operation consists of a check, cleansing, degreasing, diagnosis, replacement of valve O-rings every 12 month, the subcontracting of the tank visual check every 12 months or the retesting of the tank every 24 months in accordance to the maintenance plan (subject to local regulations) and if necessary replacement of the defective parts together with the setting up.

STORAGE AND TRANSPORTATION

5.1 Storage

Between two dives, the rebreather must be stored in a dry place, at room temperature and away from any elements that could be harmful (hydrocarbons, UV rays…).

Dust is also harmful to the rebreather. It damages O-rings and its sealing.

It is recommended to store the rebreather open (disassembled) so as not to scratch O-rings and allowing it to dry especially after a long period spent without diving.

It is also recommended to dry the rebreather high up. Parts of the rebreather stored on the ground make a good home for spiders, slugs and other animals that can seriously damage the rebreather good operation.

To optimize the life of the PpO_2 display, it is recommended to charge it every month.

Soda lime must be stored in a dry environment, at constant temperature.

To avoid any gas flow, you may close the lime scrubber using plugs supplied for this purpose (refer to section 6).

An adhesive is supplied with the TRITON® to keep track the scrubber filling date.

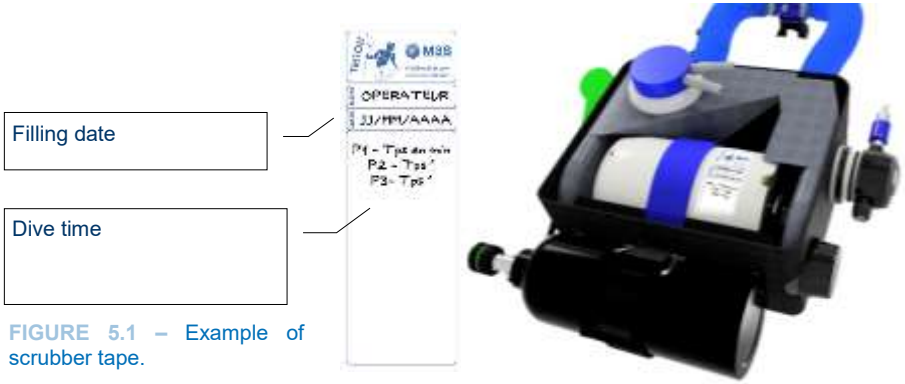


FIGURE 5.1 – Example of scrubber tape.

Warning:

Do not store lime more than 15 days (risk of bacterial development).

5.2 Transportation

Special attention will be paid to the transportation of the TRITON®. Indeed, the biggest advantage of the TRITON® with its small size and light weight make it easy to travel. However, it is still technical equipment and special care will be given to environment and conditions of transportation as follows.

5.2.1 Transportation for use (to diving spot)

When travelling to use the TRITON® (before or after dives, during set up…) it is important not to let parts connected to the TRITON® such as computers, PpO_2 display, loop and HUD swing or drag.

Warning:
The HUD's leds are robust components but a careless handling of the TRITON® leaving the loop freely hit the tank is part of bad practices and use.

There exist risk of damages the hoses when they are caught by obstacles (other equipment in cars, on boats…), or by heavier equipment (such as tanks of CO, BO, back rebreather…).

On our shop we offer a carrying bag. It protects the TRITON® which is fully assembled and ready to dive when traveling. It is easily inserted or removed from the bag thanks to its wide top opening.

FIGURE 5.2 – Transport and carrying bag.

5.2.2 Transportation for overhaul (to M3S)

We deliver the TRITON® with its box all over the world. This box has standard transport sizes and can be handled in accordance with freight forwarder's requirements.

This box has been chosen to be reused. In an environmental and safety aspect, it can be used for different purposes (rinsing tank, storage during non diving period..).

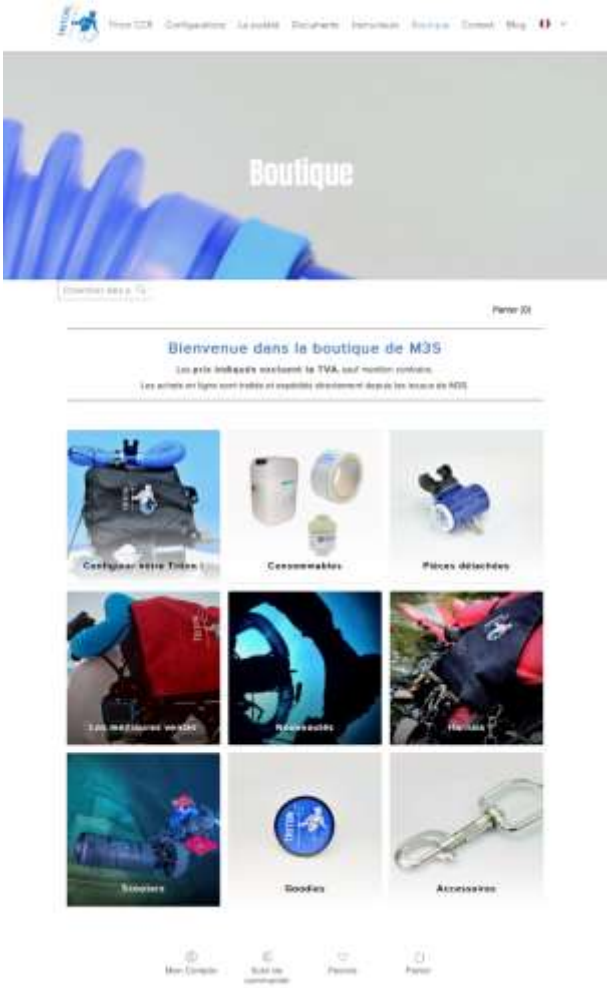
Its main use being transportation, we recommend to use it when sending the unit for overhaul or repairs.

FIGURE 5.3 – Transportation box for overhaul

OPTIONS AND CONSUMMABLES

There are a number of possible accessories to adapt, personalize your TRITON®, all these options and accessories are available on our shop.

To help you keep your TRITON® operating, all the consumables are available on our shop.



https://www.ccrtriton.com/online-store

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