GAMMA

UNDERWATER REBREATHER

The Personal Protective Equipment (PPE) in the **GAMMA** rebreather family is developed, designed, and manufactured by **SANOSUB MBB s.r.l.** in compliance with applicable industry regulations and standards. These devices are intended for professional use and special operations by experienced users. They are purely mechanical and prepared for electronic control of the breathing gas. They are available in three different types, each configurable according to the specific needs of the end user.

GAMMA OXY

OXYGEN CLOSED-CIRCUIT MECHANICAL REBREATHER (MCCR)

The base **Type** of the **GAMMA** Self-Contained Breathing Apparatus family is called **GAMMA OXY**, developed, designed, and manufactured by **SANOSUB MBB s.r.l.**

GAMMA OXY is a **M**echanical **C**losed-**C**ircuit **R**ebreather **(MCCR)** operating with 100% pure oxygen, available in two different usage Types:

- ✓ **GAMMA OXY Front**-Mount Type:
  equipped with harnesses called "Yoke" and "Front", featuring a wide-range adjustment system that ensures secure and stable attachment of the device, allowing proper adaptability to different body sizes and shapes.

- ✓ **GAMMA OXY Back**-Mount Type:
  equipped with a specific user interface vest called Jacket X-CORE, with adjustable sizing to better fit various body types. Compared to the front-mount type, the back-mount type is characterized by appropriately sized corrugated hoses and a remote bypass button kit integrated into the demand valve, positioned conveniently for the user.

COLOR AVAILABILITY

Black	Ranger Green	Coyote 498

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GAMMA

UNDERWATER REBREATHER

GAMMA X41 DUO

MECHANICAL MIXED-CIRCUIT REBREATHER OXYGEN - MIXED GAS (MMCR)

COLOR AVAILABILITY

Black	Ranger Green	Coyote 498

The **Type** from the **GAMMA** Self-Contained Breathing Apparatus family known as **GAMMA X41 DUO** is developed, designed, and manufactured by **SANOSUB MBB s.r.l.**

GAMMA X41 DUO is a **M**echanical **M**ixed-**C**ircuit **R**ebreather **(MMCR)** that supports both Closed-Circuit Oxygen Operation **(MCCR)** and Semi-Closed-Circuit Operation with Binary or Ternary Gas Mixtures **(MSCR)**, It is available in the following configurations, all equipped with a **dedicated interface jacket** for the user, with adjustable sizing to better accommodate different body types::

- ✓ **GAMMA X41 DUO T (TWIN)*:*** breathing circuit equipped with one oxygen cylinder and one mixed gas cylinder, available in either front-mount or full back-mount configurations.
- ✓ **GAMMA X41 DUO D1**: breathing circuit and oxygen cylinder mounted frontally, with a single mixed gas cylinder mounted on the back.
- ✓ **GAMMA X41 DUO D2**: breathing circuit and oxygen cylinder mounted frontally, with two mixed gas cylinders mounted on the back.
- ✓ **GAMMA X41 DUO L (Leg)**: breathing circuit and oxygen cylinder mounted either frontally or on the back, with a mixed gas cylinder mounted on the right or left leg.

In MMCR configuration, the operator can switch between MCCR and MSCR modes with one hand during the dive, in total safety.

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GAMMA

UNDERWATER REBREATHER

GAMMA AZIMUTH

MECHANICAL SEMI-CLOSE CIRCUIT REBREATHER GAS MIXTURE (MSCR)

The **Type** from the **GAMMA** Self-Contained Breathing Apparatus family known as **GAMMA AZIMUTH** is developed, designed, and manufactured by **SANOSUB MBB s.r.l.**

GAMMA AZIMUTH is a **M**echanical **S**emi-Closed **C**ircuit **R**ebreather (MSCR) for binary or ternary gas mixtures, in the following configurations:

✓ **GAMMA AZIMUTH T (TWIN)**
Breathing circuit and two back-mounted mixture cylinders

✓ **GAMMA AZIMUTH D2**
Front breathing circuit with two back-mounted mixture cylinders

COLOR AVAILABILITY

Black | Ranger Green | Coyote 498

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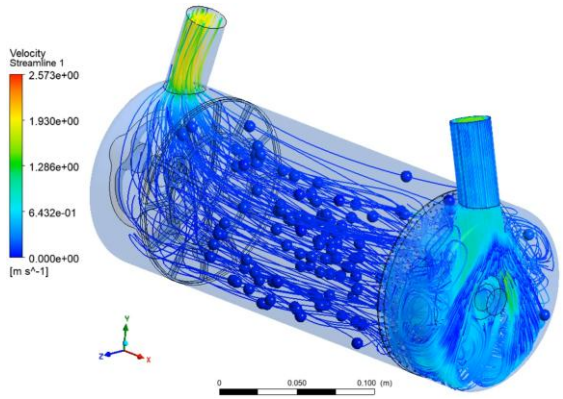
GAMMA

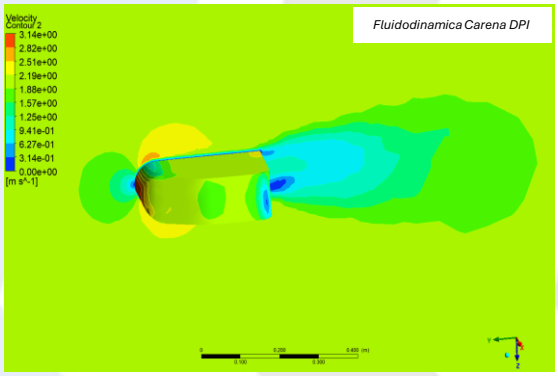
UNDERWATER REBREATHER

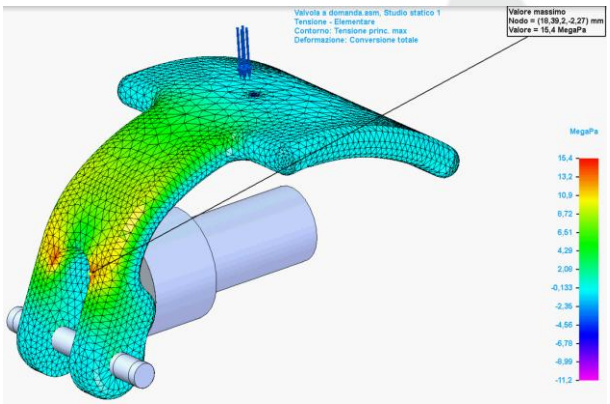
The devices in the **GAMMA** family are constructed using low magnetic signature metal components and high-performance plastics with exceptional resistance to hydrocarbons and UV radiation.
The semi-rigid, flexible outer shell protects all internal components. It is made of an innovative material resistant to abrasion, cuts, and punctures, and is available in black, ranger green, and coyote 498.
The breathing bags, made of soft, non-toxic, high-capacity material, ensure excellent breathing ease essential for operating comfortably and for extended periods while underwater.
The device is equipped with an automatic gas injection system into the breathing loop, which can be adjusted or deactivated. At any time during the dive, the operator can choose to disable the automatic injection, keeping only the manual injection active for better buoyancy control while underwater.



The high-capacity absorbent canister traps respiratory byproducts, such as carbon dioxide, with high efficiency thanks to the advanced fluid dynamics studies conducted to optimize the internal flow path. This ensures uniform usage of the entire absorbent material. Furthermore, the canister is designed with features that help reduce condensation of water vapor caused by both respiration and the CO_2 absorption reaction.

GAMMA, in its various configurations, features technical and performance characteristics that set it apart, primarily due to its lightweight design and minimal bulk. These qualities ensure high maneuverability and ease of use, with minimal restriction to the diver's movements, as well as quick and easy donning.
Its extreme compactness makes it unique in terms of hydrodynamic efficiency, with very low impact on complementary systems across different operational scenarios including diver propulsion vehicles (DPVs), for which the device enhances both drag reduction and stability during movement.
This result was achieved through engineering and fluid dynamics studies aimed at defining a design that minimizes hydrodynamic resistance and optimizes thrust balance, ensuring stable depth control during navigation.





GAMMA has been designed and engineered to optimize ease of use, maintenance, and storage. No tools are required for operation or routine maintenance.
Its respiratory performance both in terms of work of breathing (W.O.B.), which is significantly below the limits set by industry regulations, and the minimal variation in performance with changes in dive depth ensures high breathing comfort across various conditions and configurations.
The main components of the breathing circuit have been designed and engineered to support deep dives while maintaining the aforementioned respiratory performance, using advanced tools for the calculation and sizing of the different mechanical subassemblies.

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GAMMA

UNDERWATER REBREATHER

SANOSUB MBB s.r.l. has always placed User ***SAFETY*** as a core company policy throughout all phases of product design and manufacturing, certifying its products in compliance with applicable regulations, agreements, standards, and industry norms. Specifically, the **GAMMA** model, in all of its configuration types, strictly complies with the requirements set forth by the following regulations, agreements, standards, and norms, as per their latest applicable revisions:

- Regulation (EU) of the European Parliament and of the Council of 9 March 2016 on Personal Protective Equipment, replacing Council Directive 89/686/EEC. Specifically, Article 14 of **Regulation (EU) 2016/425 of the European Parliament and of the Council states** that Personal Protective Equipment which complies with *harmonised standards* or parts thereof shall be presumed to be in conformity with the **Essential Health and Safety Requirements** set out in *Annex II* of the aforementioned regulation, insofar as such requirements are covered by those standards or parts thereof, harmonised by the European Union and listed below :

  - ✓ ***EN14143:2013****-Respiratory equipment-Self-contained re-breathing diving apparatus;*
  - ✓ ***EN 144-1:2018****-Respiratory protective devices-Gas cylinder valves-Part 1: Inlet connections;*
  - ✓ ***EN 144-3:2004****-Respiratory protective devices-Gas cylinder valves-Part 3: Outlet connections for diving gases Nitrox and oxygen;*
  - ✓ ***EN 12021:2014****-Respiratory equipment-Compressed gases for breathing apparatus;*
  - ✓ ***EN ISO 10297:06-2024****-Gas cylinders-Cylinder valves-Specification and type testing;*
  - ✓ ***IEC 60812 Ed.3.0:08-2018****-Failure modes and effects analysis (FMEA and FMECA);*
  - ✓ ***EN 134:2000****-Respiratory protective devices-Nomenclature of components;*
  - ✓ ***EN 135:2000****-Respiratory protective devices-List of equivalent terms.*

- Regulation (CE) n.1907/2006 ''**REACH**'' concerning the protection of human health and safety and the environment.

- Agreements and Standards of the **North Atlantic Treaty Organization (NATO)**, aimed at safeguarding the security and freedom of the signatory States in accordance with the principles of the Charter of the United Nations :

  - ✓ Agreement ***NATO STANAG 1372*** - ***Standard NATO ADivP-01***: *''*ALLIED GUIDE TO DIVING OPERATIONS*'';*
  - ✓ Agreement ***NATO STANAG 1411*** - ***Standard NATO ADivP-03***: *''STANDARD TO QUANTIFY THE CHARACTERISTICS OF GRANULAR CARBON DIOXIDE (CO_2) ABSORBENT MATERIAL FOR DIVING AND HYPERBARIC APPLICATIONS'';*
  - ✓ Agreement ***NATO STANAG 1410*** - ***Standard NATO ADivP-05***: *''STANDARD UNMANNED TEST PROCEDURES AND ACCEPTANCE CRITERIA FOR UNDERWATER BREATHING APPARATUS'';*
  - ✓ Agreement ***NATO STANAG 1449*** - ***Standard NATO ADivP-06***: *''DIVING SYSTEM – OXYGEN CLEANING PROCEDURES AND STANDARDS'';*
  - ✓ Agreement ***NATO STANAG 1418*** - ***Standard NATO AMP-15***: *''STANDARD FOR NAVAL MINE WARFARE ACOUSTIC MEASUREMENTS'';*

- Standard **NORSOK-U-101-Rev.1-Aug.1999**: ''DIVING RESPIRATORY EQUIPMENT''.

- **NEDU TM 15-01 June 2015** - **NAVY EXPERIMENTAL DIVING UNIT** - TECHNICAL MANUAL NO. 15-01: U.S. NAVY UNMANNED TEST METHODS AND PERFORMANCE LIMITS FOR UNDERWATER BREATHING APPARATUS.

The tests conducted on **GAMMA** in laboratories recognized by certification bodies appointed by the European Union demonstrate that the intended respiratory performance objectives related to Work of Breathing (W.O.B.) have been achieved. The measured peak values fall well within the envelope of all limit values specified by the aforementioned standards, effectively resulting in curves showing low breathing effort and minimal variation in effort across a breathing rate range of 10 to 90 [l/min].

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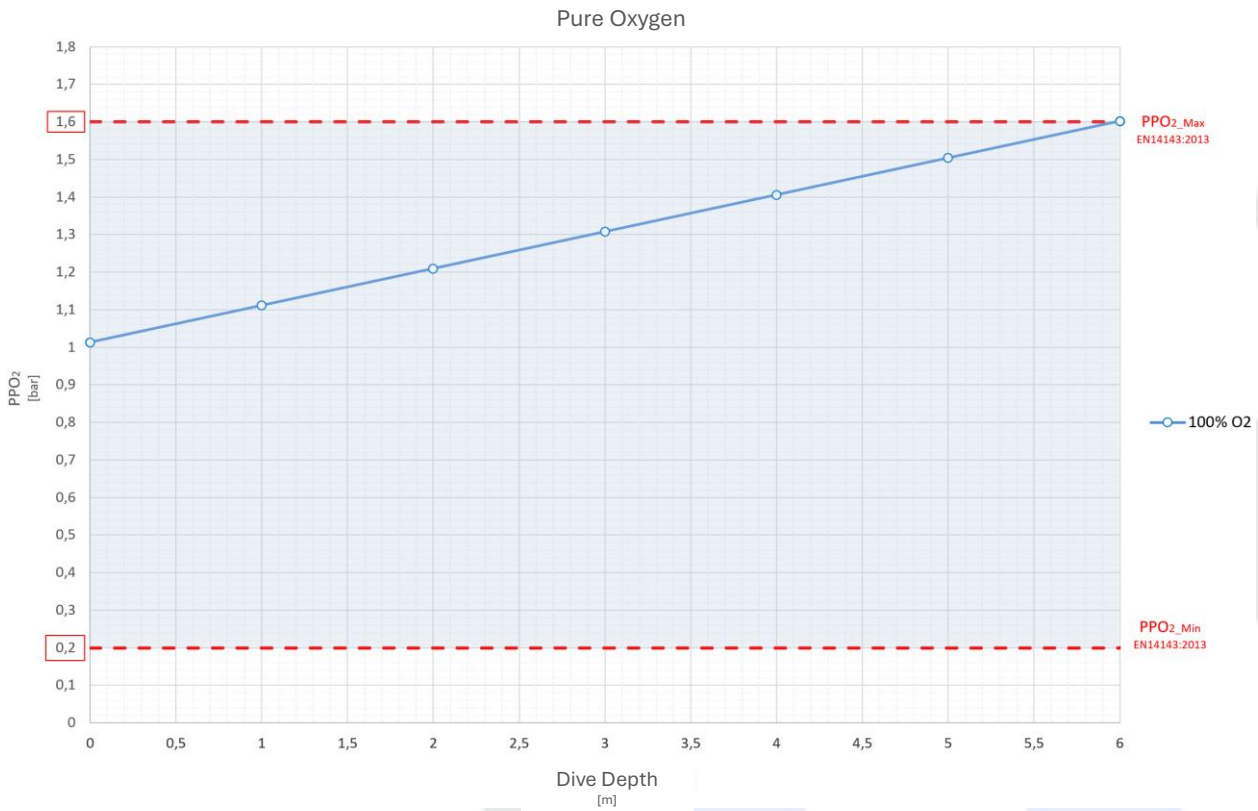
UNDERWATER REBREATHER

The **GAMMA** model, in its different Types **GAMMA X41 DUO (MMCR)** and **GAMMA AZIMUTH (MSCR)** is equipped with fixed orifice or **constant mass flow** injectors, depending on the maximum dive depth and the type of gas mixture used. According to industry standards, these mixtures are binary or ternary, with an oxygen percentage defined based on the target depth.
The oxygen fraction present in the breathing loop is generally lower than the percentage in the supply cylinder, as it is affected by the diver's metabolic consumption. Consequently, the stabilized oxygen fraction in the counterlung, combined with the injected flow rate and the oxygen content of the premixed gas, represent the key parameters that together determine the maximum reachable dive depth. At this depth, the PPE in question mechanically ensures that the maximum PPO_2 values are kept within safe limits to prevent oxygen toxicity to the user, in full compliance with applicable regulations and standards.
Once the constant mass flow rates are established for the various **GAMMA** configurations, the corresponding cylinder capacities are determined to ensure the specific autonomy required by the user at different dive depths, in accordance with standard gas mixtures defined by industry regulations.
Operating ranges are represented by performance charts or curves, where PPO_2 variation for a given gas composition is shown as a function of the diver's oxygen metabolic consumption and the maximum reachable depth, while remaining within the limits of the stabilized oxygen fraction in the breathing loop.

The operating curve of the **GAMMA OXY**, a Mechanical Closed-Circuit Oxygen Rebreather (**MCCR**) configuration, is represented by the linear law shown in the following figure. This curve highlights an increasing PPO_2 value as the dive depth increases, regardless of the diver's specific metabolic consumption, between the minimum limit of 0.2 [bar] and the maximum limit of 1.6 [bar] established by the reference standard (EN14143:2013 – section 5.7.1), reached respectively at depths of 0 [m] and 6 [m].For user safety, the pure oxygen device must not be used at depths greater than 6 [m], as the breathing gas presents toxicity levels exceeding the harmonized limit requirements, thus posing a health risk to the user.



***GAMMA OXY (MCCR)** - PPO_2 levels as a function of depth - 100% O_2*

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The operating curves of the **GAMMA X41 DUO**, a Mechanical Mixed-Circuit Rebreather **(MMCR)**, when used in Closed-Circuit Oxygen mode **(MCCR)**, follow the performance curve described in the previous paragraph. In Semi-Closed Circuit mode with binary or ternary mixtures **(MSCR)**, the performance curves are represented by the linear laws shown in the following figures, which depend both on the type of gas mixture used and the flow rate considered. These latter curves also apply to the **GAMMA AZIMUTH**, a Mechanical Semi-Closed Circuit Rebreather **(MSCR)**.

The performance curves show an increasing PPO_2 value as the dive depth increases, within the limits established by the reference standards (EN14143:2013 – section 5.7.1), with a minimum of 0.2 [bar] at surface level (0 [m]) and a maximum of 1.6 [bar] reached at the maximum depth depending on the diver's metabolic consumption.
The graphs also display the residual oxygen percentage in the counterlung corresponding to the metabolic consumption value characteristic of the considered performance curve. This parameter is fundamental for proper dive planning in terms of cylinder autonomy required to safely carry out the operational mission.

The graphs are limited to the operating curves characterized by metabolic consumption at the limit of the minimum inspired oxygen percentage allowed by regulations at ambient pressure and diving standards, below which the user is exposed to conditions hazardous to health.
The curves are plotted considering the use of the PPE with a normoxic bottom mix, therefore usable from the surface down to the dive depth without the aid of ''*travel*'' cylinders.
The maximum dive depth is calculated using Stievine's law, taking into account the actual oxygen drop in the counterlung: the oxygen percentage value reported for each curve at constant specific consumption represents the residual oxygen percentage available in the counterlung, calculated starting from the oxygen percentage in the supply mixture minus the corresponding metabolic consumption of the user.

For **Safety**, the user must respect the depth limits for the various operating curves, beyond which the inspired gas exhibits partial pressure values exceeding the harmonized limit requirements, with toxicity levels dangerous to the user's health. Additionally, the maximum metabolic consumption limits indicated in the operating diagrams must be observed. Beyond these limits, the breathing gas contains oxygen percentages below the minimum harmonized requirements, posing toxic risk if inhaled at partial pressures outside the imposed limits. Exceptionally, in cases where the user during a dive inadvertently, unexpectedly, or due to particular needs exceeds the maximum metabolic consumption limits allowed by the operating diagrams, it will be possible to quickly return within the "curve" by restoring the oxygen percentage to safe levels through manual injection of fresh gas mixture with a higher oxygen content from the cylinders by activating the device's bypass button.

The PPO_2 value curve varies depending on mass flow, metabolic consumption, and depth. Additionally, each PPO_2 curve is characterized by a specific residual oxygen percentage in the breathing gas. Therefore, for the user's **Safety**, it is essential to equip oneself with an appropriate **Inspired Gas Analyzer Device** for continuous monitoring of critical parameters such as partial pressure and residual oxygen percentage in the inhaled gas, with an **Active Alarm** triggered upon exceeding the harmonized maximum and minimum limits specified in the following curves, or as dictated by official dive manuals or regulations of the relevant certification bodies and/or qualifications held.

The devices of the **GAMMA** family are designed to interface with standard gas analysis devices via a quick-connect fitting located on the inhalation counterlung.

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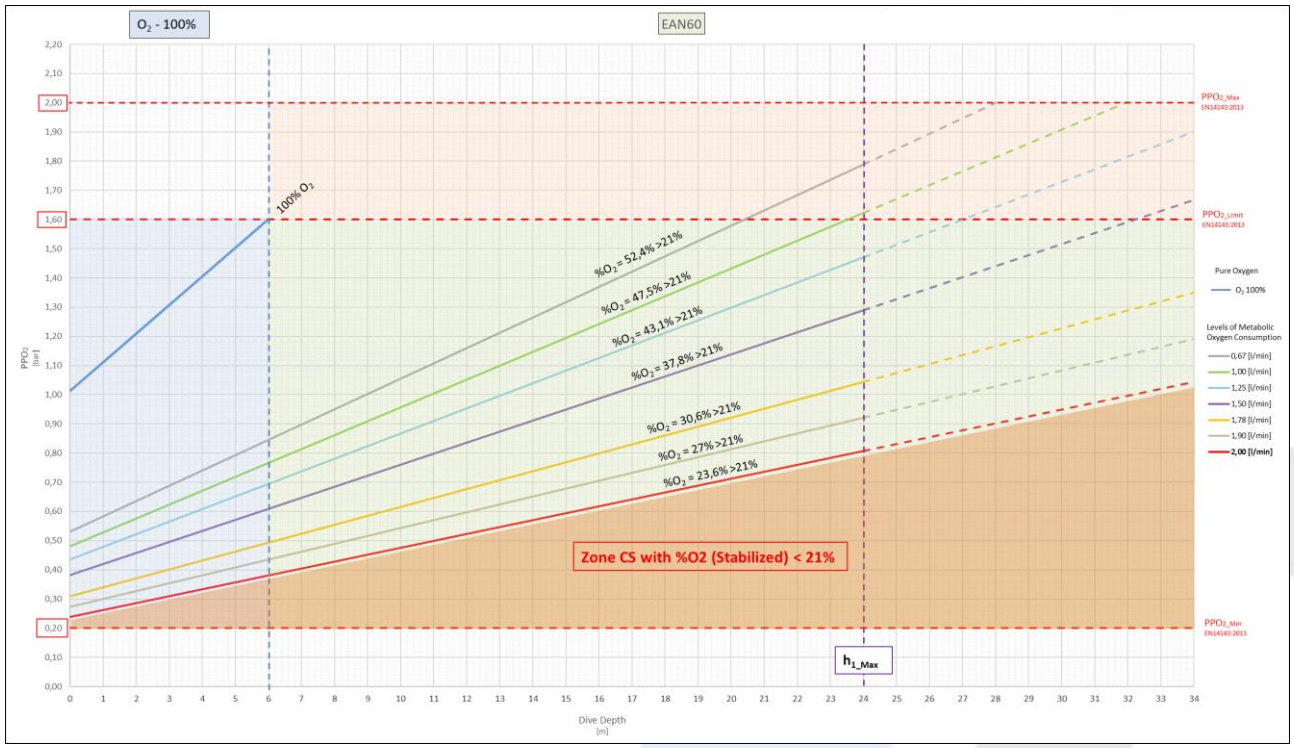
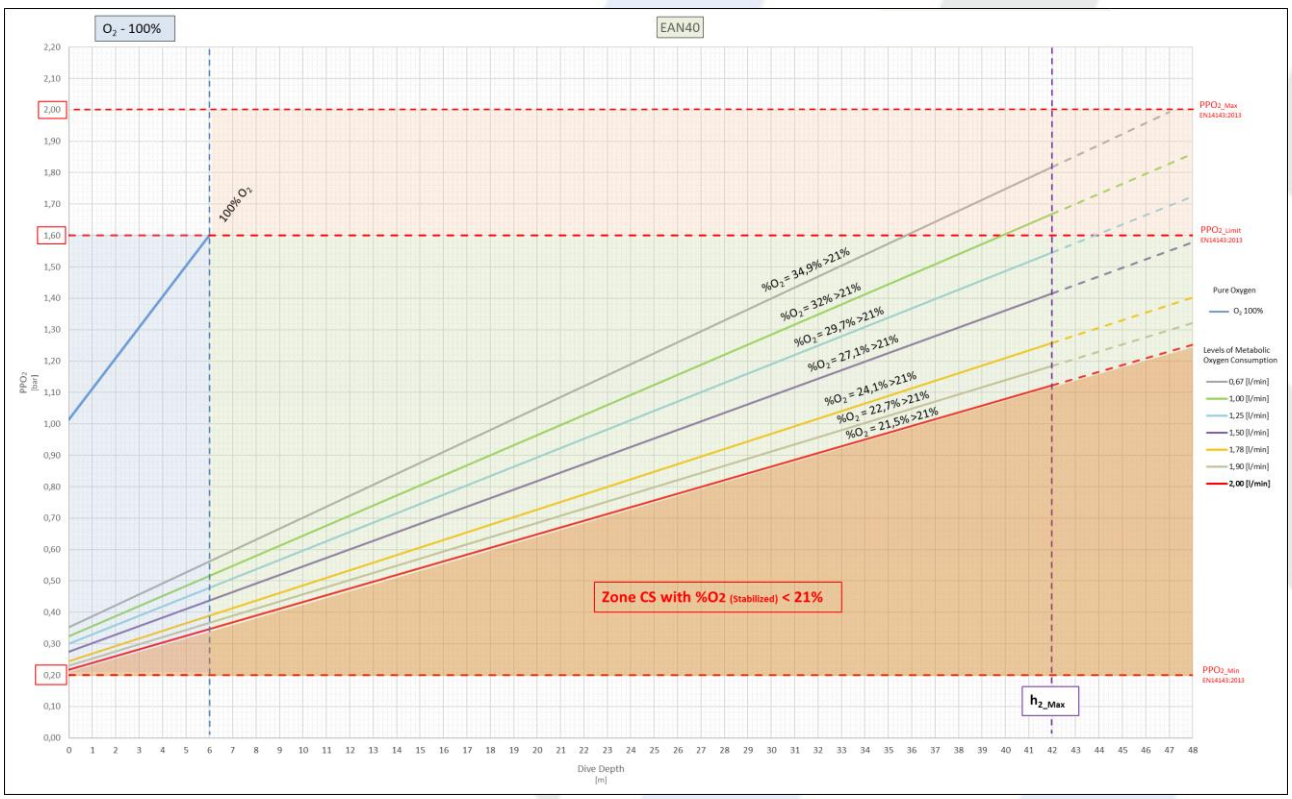
Performance Curves of GAMMA AZIMUTH (MSCR) and GAMMA X41 DUO (MMCR) *Used in* ***MSCR*** *Configuration*



PPO_2 Levels as a Function of Depth and O_2 Consumption - EAN 60% O2



PPO_2 Levels as a Function of Depth and O_2 Consumption - EAN 40% O2

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PPO_2 Levels as a Function of Depth and O_2 Consumption - EAN 32,5% O2

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GAMMA

UNDERWATER REBREATHER

TECHNICAL DATA

GAMMA OXY				
Operating Configuration	Mechanical Closed-Circuit Pure Oxygen **(MCCR)**			
Gas Injection System	Manual Button (Bypass) and/or Adjustable Automatic (AODV) or Automatic Only (ODV)			
CYLINDERS				
Materials	Aluminum Alloy, Steel, or Composite			
Outlet Connection	M26x2 o G3/4			
Maximum Pressure	232 [bar]			
Gas Type	Pure Oxygen 100% (EN12021 - prosp.6)			
Standard Capacity	1 x 1.5 [l]			
Total Volume at 232 [bar]	348 [l]			
Available Volume	273 [l] With a reserve of 50 [bar] in the cylinder		303 [l] With a reserve of 30 [bar] in the cylinder	
Oxygen Gas Endurance as a Function of the Diver's Metabolic Consumption	$CS_{Metabolic\ Consumption}$ [l/min]	$T_{Duration}$ [min]	$CS_{Metabolic\ Consumption}$ [l/min]	$T_{Duration}$ [min]
	0,67	407	0,67	452
	1,00	273	1,00	303
	1,25	218	1,25	242
	1,60	171	1,60	190
	1,78	153	1,78	170
	2,20	124	2,20	138
	2,45	111	2,45	124
	2,78	98	2,78	109
	3,33	82	3,33	91
CO_2 ABSORBENT FILTER				
CO_2 Absorbent Material	Soda lime in **Granules** or Pre-filled **MicroPore EXTENDAIR®** (Soda lime compliant with NATO STANAG 1411 – NATO Standard ADivP-03)			
Filter capacity	3 [kg]			
Filter duration	~ 200 minutes Test conditions: Temp.= 4 [°C], RMV = 40 [l/min], Injected CO_2 =1,6 [l/min], CS = 1,78 [l/min] Soda lime used: **Dräger DIVESORB® PRO**			
BREATHING BAGS				
Maximum volume According to EN14143	6 [l]			
Material	High-strength non-toxic polyurethane			
TEMPERATURE				
Storage temperature	from -30 [°C] to +70 [°C]			
Operating temperature	from +1 [°C] to +40 [°C]			
WEIGHTS				
Weight empty in air (Without lime and oxygen)	9,8 [kg]			
Weight ready for use in air (With 3 [kg] lime and N°1 Cylinder of 1,5 [l] O_2)	13,3 [kg]			
Ready-to-use weight underwater (With 3 [kg] lime and N°1 Cylinder of 1,5 [l] O_2)	Neutral with a breath of 1.4 [l] of gas in the breathing circuit			

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CONFIGURATION CODES

TYPE		CONFIGURATION	CODE (*)
MCCR Mechanical Closed-Circuit Rebreather Oxygen	**GAMMA OXY**	Pure Oxygen – Ventral Unit (Standard configuration with yoke and ventral strap for PPE attachment)	MCCR-VBK-1R1M
		Pure Oxygen – Ventral Unit (Configuration with X41 Jacket, consisting of the X-Core Jacket assembly for PPE attachment, equipped with quick-release weight pockets)	MCCR-VBK-1R2M
		Pure Oxygen – Dorsal Unit (Configurazione con Jacket X-Core BC, costituito dall'assieme Jacket X-Core per il fissaggio del DPI, con Buoyancy Compensator)	MCCR-DBK-1R3M

(*)
The codes indicated for the different configurations refer to Black (**BK**) and Magnetic (**M**) devices, therefore:

- For **Non-Magnetic** Devices, replace the letter **M** at the end of the code with the letter **N**;
- For the other available **Colors**, replace the letters **BK** (Black color) with **RG** for Ranger Green and **CT** for Coyote 498.

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GAMMA

UNDERWATER REBREATHER

SANOSUB UNDER PRESSURE EQUIPMENT

TECHNICAL DATA

GAMMA X41 DUO Mechanical Mixed-Circuit Rebreather (MMCR)					
Operating Configuration		Mechanical Closed-Circuit Pure Oxygen **(MCCR)**		Mechanical Semi-Closed Circuit Mixture **(MSCR)**	
Gas Injection System		Manual Button (Bypass) and Adjustable Automatic (ADV)		Manual Button (Bypass), Adjustable Automatic (ADV), and Automatic with Mass Flow Calibrated for the Adopted Gas Mixture	
CYLINDERS					
Materials		Aluminum Alloy, Steel, or Composite			
Outlet Connection		M26x2 o G3/4			
Maximum Pressure		232 [bar]			
Operating Configuration		Mechanical Closed-Circuit Pure Oxygen **(MCCR)**			
Gas Type		Pure Oxygen 100% (EN12021 - prosp.6)			
Standard Capacity		1 x 1.5 [l]			
Total Volume at 232 [bar]		348 [l]			
Available Volume		273 [l] With a reserve of 50 [bar] in the cylinder		303 [l] With a reserve of 30 [bar] in the cylinder	
Oxygen Gas Endurance as a Function of the Diver's Metabolic Consumption		$CS_{Metabolic\ Consumption}$ [l/min]	$T_{Duration}$ [min]	$CS_{Metabolic\ Consumption}$ [l/min]	$T_{Duration}$ [min]
		0,67	407	0,67	452
		1,00	273	1,00	303
		1,25	218	1,25	242
		1,60	171	1,60	190
		1,78	153	1,78	170
		2,20	124	2,20	138
		2,45	111	2,45	124
		2,78	98	2,78	109
		3,33	82	3,33	91
Operating Configuration		Mechanical Semi-Closed Circuit Mixture **(MSCR)**			
Gas Type		Nitrox Mixtures (EN12021 - prosp.7)			
Standard Capacity		2 x 1.5 [l] Standard capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		696 [l]			
Available Volume		546 [l] With a reserve of 50 [bar] in the cylinder		606 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	130	4,2	144
	42	8,5	64	8,5	71
	54	13,7	40	13,7	44
	Standard constant mass flows can be customized according to the specific needs of the User				

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GAMMA

UNDERWATER REBREATHER

SANOSUB UNDER PRESSURE EQUIPMENT

TECHNICAL DATA

CO_2 ABSORBENT FILTER				
CO_2 Absorbent Material	Soda lime in **Granules** or Pre-filled **MicroPore EXTENDAIR®** (Soda lime compliant with NATO STANAG 1411 – NATO Standard ADivP-03)			
Filter capacity	3 [kg]			
Filter duration	~ 200 minutes Test conditions: Temp.= 4 [°C], RMV = 40 [l/min], Injected CO_2 =1,6 [l/min], CS = 1,78 [l/min] Soda lime used: **Dräger DIVESORB® PRO**			
BREATHING BAGS				
Maximum volume According to EN14143	6 [l]			
Material	High-strength non-toxic polyurethane			
TEMPERATURE				
Storage temperature	from -30 [°C] to +70 [°C]			
Operating temperature	from +1 [°C] to +40 [°C]			
WEIGHTS				
Operating Configuration	**GAMMA X41 DUO** Closed Circuit Pure Oxygen **(MCCR)**			
Weight empty in air (Without lime and oxygen)	9,8 [kg]			
Weight ready for use in air (With 3 [kg] lime and N°1 Cylinder of 1,5 [l] O_2)	13,3 [kg]			
Ready-to-use weight underwater (With 3 [kg] lime and N°1 Cylinder of 1,5 [l] O_2)	Neutral with a breath of 1.4 [l] of gas in the breathing circuit			
Operating Configuration	**GAMMA X41 DUO** Mixed Circuit **(MMCR)**			
Ventral Oxygen Unit		***Dorsal Nitrox Unit***		***Total Weight (MMCR)***
Weight empty in air (Without lime and oxygen)	10,9 [kg]	Weight empty in air (Without gas mixture)	11,5 [kg]	22,4 [kg]
Weight ready for use in air (With 3 [kg] lime and N°1 Cylinder of 1,5 [l] O_2)	14,4 [kg]	Weight ready for use in air (With N°2 Cylinder of 1,5 [l] di Gas Mixture)	12,5 [kg]	26,9 [kg]
Ready-to-use weight underwater (With 3 [kg] lime, N°1 Cylinder of 1,5 [l] O_2 and N°2 Cylinder of 1,5 [l] gas Mixture)	Neutral with a breath of 2.5 [l] of gas in the breathing circuit			

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CONFIGURATION CODES

TYPE		CONFIGURATION	CODE (*)
MMCR Mechanical Mixed-Circuit Rebreather Oxygen - Mixture	**GAMMA X41 DUO**	Prepared for Basic pure oxygen and mixes, suitable for all mixture configurations – Ventral unit	MMCR-VBK-1R0M
		Prepared for Basic pure oxygen and mixes, suitable for all mixture configurations – Dorsal unit	MMCR-DBK-1R0M
	GAMMA X41 DUO T1 (TWIN)	Pure oxygen and mixtures – TWIN version, ventral unit – Jacket X41 BC	MMCR-VBK-1R1M
		Pure oxygen and mixtures – TWIN version, dorsal unit – Jacket X-Core BC	MMCR-DBK-1R1M
	GAMMA X41 DUO D1	Pure oxygen and mixtures – 1 dorsal mixture cylinder, ventral unit – Jacket X41 BC	MMCR-VBK-1R2M
	GAMMA X41 DUO D2	Pure oxygen and mixtures – 2 dorsal mixture cylinders, ventral unit – Jacket X41	MMCR-VBK-1R3M
	GAMMA X41 DUO L	Pure oxygen and mixtures – 1 leg mixture cylinder, ventral unit – Jacket X-Core BC	MMCR-VBK-1R4M
		Pure oxygen and mixtures – 1 leg mixture cylinder, dorsal unit – Jacket X-Core BC	MMCR-DBK-1R4M

(*)
The codes indicated for the different configurations refer to Black (**BK**) and Magnetic (**M**) devices, therefore:

- For **Non-Magnetic** Devices, replace the letter **M** at the end of the code with the letter **N**;
- For the other available **Colors**, replace the letters **BK** (Black color) with **RG** for Ranger Green and **CT** for Coyote 498.

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GAMMA

UNDERWATER REBREATHER

TECHNICAL DATA

GAMMA AZIMUTH					
Operating Configuration		Mechanical Semi-Close Circuit Rebreather gas Mixture **(MSCR)**			
Gas Injection System		Automatic with Mass Flow Calibrated for the Adopted Gas Mixture Manual Button (Bypass) Otional: Adjustable Automatic (ADV)			
CYLINDERS					
Materials		Aluminum Alloy, Steel, or Composite			
Outlet Connection		M26x2 o G3/4			
Maximum Pressure		232 [bar]			
Operating Configuration		**GAMMA AZIMUTH T (TWIN)** Breathing circuit and two back-mounted gas mixture cylinders			
Gas Type		Nitrox Mixtures (EN12021 - prosp.7)			
Capacity Option 1		**2 x 5 [l]** Capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		2320 [l]			
Available Volume		1820 [l] With a reserve of 50 [bar] in the cylinder		2020 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	433	4,2	481
	42	8,5	214	8,5	238
	54	13,7	133	13,7	147
	Standard constant mass flows can be customized according to the specific needs of the User				
Capacity Option 2		**2 x 4 [l]** Capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		1856 [l]			
Available Volume		1456 [l] With a reserve of 50 [bar] in the cylinder		1616 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	347	4,2	385
	42	8,5	171	8,5	190
	54	13,7	106	13,7	118
	Standard constant mass flows can be customized according to the specific needs of the User				
Capacity Option 3		**2 x 3 [l]** Capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		1392 [l]			
Available Volume		1092 [l] With a reserve of 50 [bar] in the cylinder		1212 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	260	4,2	288
	42	8,5	128	8,5	142
	54	13,7	80	13,7	88
	Standard constant mass flows can be customized according to the specific needs of the User				

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GAMMA

UNDERWATER REBREATHER

TECHNICAL DATA

Operating Configuration		**GAMMA AZIMUTH T (TWIN)** Breathing circuit and two back-mounted gas mixture cylinders			
Gas Type		Nitrox Mixtures (EN12021 - prosp.7)			
Capacity Option 4		**2 x 2 [l]** Capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		928 [l]			
Available Volume		728 [l] With a reserve of 50 [bar] in the cylinder		808 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	173	4,2	192
	42	8,5	85	8,5	95
	54	13,7	53	13,7	59
	Standard constant mass flows can be customized according to the specific needs of the User				

Operating Configuration		**GAMMA AZIMUTH D2** Front breathing circuit with two back-mounted mixture cylinders			
Gas Type		Nitrox Mixtures (EN12021 - prosp.7)			
Standard Capacity		2 x 1.5 [l] Standard capacities can be customized according to the specific needs of the User			
Total Volume at 232 [bar]		696 [l]			
Available Volume		546 [l] With a reserve of 50 [bar] in the cylinder		606 [l] With a reserve of 30 [bar] in the cylinder	
Gas Autonomy as a Function of the Standard Constant Mass Flow Regulator	h_{max} [m]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]	Φ_{Flow} [l/min]	$T_{Duration}$ [min]
	24	4,2	130	4,2	144
	42	8,5	64	8,5	71
	54	13,7	40	13,7	44
	Standard constant mass flows can be customized according to the specific needs of the User				

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GAMMA

UNDERWATER REBREATHER

SANOSUB UNDER PRESSURE EQUIPMENT

TECHNICAL DATA

CO_2 ABSORBENT FILTER				
CO_2 Absorbent Material	Soda lime in **Granules** or Pre-filled **MicroPore EXTENDAIR®** (Soda lime compliant with NATO STANAG 1411 – NATO Standard ADivP-03)			
Filter capacity	3 [kg]			
Filter duration	~ 200 minutes Test conditions: Temp.= 4 [°C], RMV = 40 [l/min], Injected CO_2 =1,6 [l/min], CS = 1,78 [l/min] Soda lime used: **Dräger DIVESORB® PRO**			
BREATHING BAGS				
Maximum volume According to EN14143	6 [l]			
Material	High-strength non-toxic polyurethane			
TEMPERATURE				
Storage temperature	from -30 [°C] to +70 [°C]			
Operating temperature	from +1 [°C] to +40 [°C]			
WEIGHTS				
Operating Configuration	**GAMMA AZIMUTH T (TWIN)** Breathing circuit and two back-mounted gas mixture cylinders			
	Cylinder Option 1 (2 cylinders x 5 [l])	**Cylinder Option 2** (2 cylinders x 4 [l])	**Cylinder Option 3** (2 cylinders x 3 [l])	**Cylinder Option 4** (2 cylinders x 2 [l])
	Magnetic (M): N°2 Cylinders ***LUXFER*** **5 [l]** @232 [bar]	*Non-Magnetic (N):* N°2 Cylinders ***ARMOTECH*** **4 [l]** @232 [bar]	*Magnetic (M):* N°2 Cylinders ***LUXFER*** **3 [l]** @232 [bar]	*Non-Magnetic (N):* N°2 Cylinders ***ARMOTECH*** **2 [l]** @232 [bar]
Weight empty in air (Without lime and mixture)	16,8 [kg]	15,9 [kg]	14,7 [kg]	13,9 [kg]
Weight ready for use in air (With 3 [kg] lime and N°2 Cylinders of gas Mixture)	22,6 [kg]	21,2 [kg]	19,4 [kg]	18,0 [kg]
Ready-to-use weight underwater (With 3 [kg] lime and N°2 Cylinders of gas Mixture)	Neutral with a breath of 2 [l] of gas in the breathing circuit	Neutral with a breath of 1,9 [l] of gas in the breathing circuit	Neutral with a breath of 1,8 [l] of gas in the breathing circuit	Neutral with a breath of 1,7 [l] of gas in the breathing circuit
Operating Configuration	**GAMMA AZIMUTH D2** Front breathing circuit with two back-mounted mixture cylinders			
	Magnetic Cylinders *(M):* N°2 Cylinders ***LUXFER*** **1,5 [l]** @232 [bar]		*Non-Magnetic* Cylinders (N): N°2 Cylinders ***ARMOTECH*** **1,5 [l]** @232 [bar]	
Weight empty in air (Without lime and mixture)	16,2 [kg]		12,8 [kg]	
Weight ready for use in air (With 3 [kg] lime and N°2 Cylinders of gas Mixture)	20,0 [kg]		16,6 [kg]	
Ready-to-use weight underwater (With 3 [kg] lime and N°2 Cylinders of gas Mixture)	Neutral with a breath of 1,9 [l] of gas in the breathing circuit		Neutral with a breath of 1,5 [l] of gas in the breathing circuit	

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CONFIGURATION CODES

TIPO		CONFIGURAZIONE	CODICE (*)
MSCR Mechanical Semi-Closed Circuit Rebreather Mixture	**GAMMA AZIMUTH**	Pure mixture configured for all configurations – ventral unit	MSCR-VBK-1R0M
		Pure mixture configured for all configurations – dorsal unit	MSCR-DBK-1R0M
	GAMMA AZIMUTH T (TWIN)	Pure mixture – TWIN version, dorsal unit with 2 cylinders – Jacket BC	MSCR-DBK-1R1M
	GAMMA AZIMUTH D2	Pure mixture – ventral unit, 2 dorsal cylinders – Jacket X-Core BC	MSCR-VBK-1R2M

(*)
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GAMMA

UNDERWATER REBREATHER

ACCESSORIES

Jacket X41
(with Weight Pocket)

COLOR AVAILABILITY

Black	Ranger Green	Coyote 498

ORDER CODE

JXCB-SM1-BK1M	JXCB-SM1-RG1M	JXCB-SM1-CT1M

The Jacket X41 with Weight Pocket, designed for diving with the GAMMA, allows for long dives without the fatigue caused by a weight belt.

The Jacket X41 with Weight Pocket is made by assembling the basic Jacket X-CORE with the Weight Pocket component; the modular system allows the weight pocket to be replaced with other devices such as a BC (Buoyancy Compensator) or cylinder pouch.

The spacious back pockets can hold up to 12 kg of traditional belt weights (4 kg per pocket).

In case of emergency or necessity, the pocket can be released by a handle located on the right shoulder. The position of the handle makes it easy to locate and operate, even by a second operator.

The jacket size is adjustable to better fit different body types; it is possible to vary the length of the ventral band and its distance from the shoulders. Additionally, the position of the ventral straps for attaching the rebreather can be adjusted.

The jacket is also equipped with a sturdy handle near the neck.

Furthermore, it is prepared for attaching ballistic plates, auxiliary cylinders (bailout or gas mixtures), and inflatable systems for buoyancy control or emergency use.

It is made from state-of-the-art materials that ensure extreme durability and unmatched lightness.

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GAMMA

UNDERWATER REBREATHER

ACCESSORIES

Jacket X-Core BC
(with Buoyancy Compensator)

COLOR AVAILABILITY

Black	Ranger Green	Coyote 498

ORDER CODE

JXBC-SM1-BK1M	JXBC-SM1-RG1M	JXBC-SM1-CT1M

The Jacket X41 with BC (Buoyancy Compensator), consisting of the basic Jacket X-CORE assembly and the BC, is specifically designed to interface with the GAMMA.

The BC increases the ability to control the depth level to be maintained during a dive, ensuring stable buoyancy and a constant depth, as well as controlled descents and ascents, all thanks to its high buoyancy capacity (standard 14 liters), which can be customized according to the end user's specific needs.

The BC has been designed in compliance with all the requirements of the current industry standards (**EN1809**), and is therefore equipped with:

- Oral inflation device;
- Compressed gas inflation device;
- Manual deflation device;
- Pressure relief valve;
- Water drain device for any trapped water;
- Harness for attachment to the main breathing device GAMMA;

The basic jacket X-CORE, serving as the interface between the BC and the GAMMA breathing device, is adjustable to better fit different body types by allowing modifications to the length of the ventral band and its distance from the shoulders, as well as the position of the ventral straps for attaching the rebreather.

The jacket is equipped with a sturdy handle near the neck and is prepared for the attachment of ballistic plates and auxiliary cylinders. It is constructed from state-of-the-art materials that ensure extreme durability and unmatched lightness.

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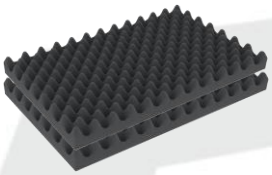
GAMMA

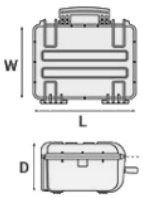
UNDERWATER REBREATHER

ACCESSORIES

STORAGE AND TRANSPORT CONTAINER - SMALL SIZE (50 lt)
(suggested to contain the GAMMA OXY)

Contain two convoluted foams





INTERNAL DIMENSIONS	
L LENGTH	538 mm
W WIDTH	405 mm
D DEPTH	250 mm
LID	60 mm
BASE	190 mm

EXTERNAL DIMENSIONS	
L LENGTH	627 mm
W WIDTH	475 mm
D DEPTH	292 mm

OTHER DATA	
WEIGHT EMPTY	10 Kg
WEIGHT WITH FOAM	11.25 Kg
WEIGHT WITH CUSTOM FOAM	Kg
VOLUME	53 lt
BUOYANCY	37.20 Kg/max
OPERATING TEMPERATURE	°C min -33 / max +90

WATERPROOF CASE
Resistant to chemicals, humidity and dust.
Resistant to harshest temperatures (-33°C / +90°C).
Custom foams available on demand.
Self oiling free running wheels.

COLOR AVAILABILITY

Black	Ranger Green

ORDER CODE

RCTR-EBK-200M	RCTR-ERG-200M

CERTIFICATION
STORAGE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
VIBRATION TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
TEMPERATURE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT VERTICAL TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT HORIZONTAL TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
DRY-HEAT TEST & LOW TEMPERATURE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT VERTICAL TEST & IMPACT HORIZONTAL TEST AFTER DRY HEAT TEST & LOW IP 67 CODE TEST - CEI EN 60529

QUALITY MANAGEMENT SYSTEM
CERTIFIED ISO 9001:2015 AND ISO 13485:2016

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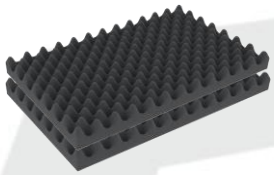
GAMMA

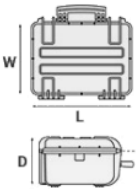
UNDERWATER REBREATHER

ACCESSORIES

STORAGE AND TRANSPORT CONTAINER - MEDIUM SIZE (84 lt)
(suggested to contain the GAMMA X41 DUO or GAMMA AZIMUTH)

Contain two convoluted foams





INTERNAL DIMENSIONS	
L LENGTH	580 mm
W WIDTH	440 mm
D DEPTH	330 mm
LID	60 mm
BASE	270 mm

EXTERNAL DIMENSIONS	
L LENGTH	670 mm
W WIDTH	510 mm
D DEPTH	372 mm

OTHER DATA	
WEIGHT EMPTY	10.54 Kg
WEIGHT WITH FOAM	12.65 Kg
WEIGHT WITH CUSTOM FOAM	Kg
VOLUME	84.20 lt
BUOYANCY	62 Kg/max
OPERATING TEMPERATURE	°C min -33 / max +90

WATERPROOF CASE
Resistant to chemicals, humidity and dust.
Resistant to harshest temperatures (-33°C / +90°C).
Custom foams available on demand.
Self oiling free running wheels.

COLOR AVAILABILITY

Black	Ranger Green

ORDER CODE

RCTR-EBK-201M	RCTR-ERG-201M

CERTIFICATION
STORAGE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
VIBRATION TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
TEMPERATURE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT VERTICAL TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT HORIZONTAL TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
DRY-HEAT TEST & LOW TEMPERATURE TEST - STANAG 4280 / DEF-STD 81-41 (Part 3 Issue 4)
IMPACT VERTICAL TEST & IMPACT HORIZONTAL TEST AFTER DRY HEAT TEST & LOW IP 67 CODE TEST - CEI EN 60529

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GAMMA

UNDERWATER REBREATHER

HOSE PROTECTION PAIR

These protective textile sleeves are designed to shield the corrugated hoses from abrasion, heat, and chemical exposure. Made from durable materials, they ensure extended hose life and enhanced safety in demanding environments. Easy to install, they provide flexibility while maintaining hose integrity.

COLOR AVAILABILITY

Black	Ranger Green	Coyote 498

ORDER CODE

ACOV-SBK-101M	ACOV-SRG-101M	ACOV-SCT-101M

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