ZEAGLE
DEFENDER EBS
EMERGENCY BREATHING SYSTEM
USER MANUAL

Huish Outdoors Part

PN 350-9300 ZEAGLE DEFENDER EBS 310 BAR SYSTEM
PN 350-9310 ZEAGLE DEFENDER EBS 310 BAR SYSTEM w/ ON/OFF

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MANUFACTURER

The Emergency Breathing System (EBS) is manufactured by Huish Outdoors, Inc
1540 2200 W, Salt Lake City, UT 84116, USA

TRADEMARK NOTICE

EC TYPE EXAMINATION CONDUCTED BY:

Products carrying the CE mark have the EC Type Examination conducted by:
SGS Fimko Oy, Takomotie 8, FI-00380 Helsinki, Finland.
Notified Body 0598

All products sold by Zeagle in the EU (European Union) comply with the following requirements where applicable.

EN12021: This standard specifies the allowable contaminates and component gases that make up compressed breathing air. This standard is the equivalent of the USA Compressed Gas Association's Grade E air. Both standards allow very small amounts of contaminants that are not harmful to breathe but can cause a problem if present in systems using gases with a high percentage of oxygen.

EN4856: The EBS is considered an Emergency Self Contained Emergency Underwater Breathing Apparatus. As such, the EBS is designed for user deployment and operation with sufficient notice given to the user to deploy the device.

A "Declaration of Conformity" is on the Huish Outdoors website at:
https://www.huishoutdoors.com/eu-declarations/declarations-of-conformity/

The Zeagle Defender EBS is certified as an underwater escape breathing apparatus for use to a maximum depth of 4m in water temperatures of 4°C or greater. It is certified that the EBS meets the Essential Health and Safety Requirements in Annex II of Regulation (EU) 2016/425 Personal Protective Equipment. This PPE satisfies the requirements for a shallow water underwater escape breathing apparatus based on relevant principles and elements of EN4856:2023 - Rotorcraft Emergency Breathing Systems (EBS), requirements, testing and marking and harmonized standard EN250:2014 - Respiratory Equipment open circuit, self-contained, compressed air diving apparatus, requirements, testing and marking. It is designed to protect the user's airways in an underwater environment.

WARNINGS, CAUTIONS, AND NOTES

Pay attention to the following symbols when they appear throughout this document. They denote important information and tips.

WARNINGS: ARE INDICATORS OF IMPORTANT INFORMATION THAT IF IGNORED MAY LEAD TO INJURY OR DEATH.

CAUTIONS: indicate information that will help you avoid product damage, faulty assembly, or unsafe conditions.

NOTES: indicates tips and advice.

WARNING: It is essential that the user read this guide to familiarize themselves with the proper set-up, care & maintenance, and use of this product. If the instructions given in this guide are not understood and followed, possible injury or death may result.

The Defender EBS is intended to be used as a device to assist an individual in self-rescue to escape from an emergency situation involving submergence in shallow water for a brief period. It is not designed nor tested for any other purpose.

WARNING: Proper training is essential for safety. One must be trained in breathing compressed gases, in-water survival, and emergency egress. You must be familiar with and trained in the use of this particular device to maximize your effective use of it. Failure to respond to this warning could result in a situation leading to serious injury or death.

WARNING: This device must be tested and inspected for proper operation at regular intervals. If any part does not function properly, IT MUST BE REMOVED FROM SERVICE.

WARNING: The EBS has a limited capacity to deliver AIR for only a brief period in shallow water (4m;13 ft), after accidental or unplanned submersion of the user. The time duration for supplying air will vary between individuals and breathing rates. This is an indicator supporting the need for training to maximize effective use of the device. It IS NOT intended to be and must NEVER be used as a supplemental gas supply in SCUBA diving.

WARNING: Compressed Breathing AIR used with the EBS must conform to CGA Grade D or E standards, or at least EN 12021 Breathing Air requirements.

WARNING: As with all underwater life support equipment, improper use or misuse of this product can cause serious injury or death.

WARNING: Never overfill the EBS unit.

WARNING: The unit should always be pressurized to mitigate corrosion and contamination of internal components. If the unit has been exposed to water ingress or contamination it must be serviced and cleaned by a qualified technician prior to being put back into service.

WARNING: Discontinue use of any EBS unit after exposure to extreme heat in excess of 250°F / 121°C.

WARNING: Units shall be serviced and maintained by trained and authorized technicians. The cylinder must be inspected and serviced in accordance with all local governing agencies. Equipment that is not routinely serviced in a proper manner creates an unsafe condition that could lead to serious injury or death.

Cylinders should never be dragged or dropped.

Never remove the valve from the cylinder before it is fully discharged. Refitting the valve should only be operated by trained personnel.

WARNING: Never use corrosive chemicals, caustic, or acid paint strippers, burning techniques, or solvents, in order to remove paints from aluminum or composite surfaces. If the cylinder has been exposed to unknown chemicals or aggressive fluids, the cylinder must be checked and seek advice before continued use. Always refer to Cylinder Manufacturers User Manuals.

WARNING: Do not attempt to use in waters of less than 4 ºC / 39°F.

WARNING: the integrated cylinder valve and first stage must always be in the ON position any time the EBS is in service and ready to be deployed. If the valve has been closed to the OFF position at any time, it must be fully reopened to the ON position by rotating fully counterclockwise before it is acceptable for use. DO NOT place the unit into service without ensuring it is in the ON position. Failure to ensure unit is in the ON position will render the EBS incapable of delivering air to the user.

WARNING: the EBS is shipped in the "OFF" position with an empty cylinder. failure to ensure that the EBS is "On" as described and cylinder is full will render the EBS incapable of delivering AIR to the user. never turn off the AIR supply except for taking unit out of service or repair.

Do not test the operation of the EBS without ensuring that the system can be re-filled to its maximum working pressure immediately after the test, and before in-service placement.

INTRODUCTION

The Defender Emergency Breathing System (EBS) is a device intended to assist an individual to escape from an emergency situation involving involuntary submergence below water, such as that which might occur with a downed aircraft in a body of water.

It is a self-contained system that features a robust design with particular attention to simplicity, reliability and convenient compact size to enable ease of use and maintenance.

Additional features that include adjustable mouthpiece positions, a flexible hose with swivel connections and convenient port connections provide desirable options for the user to adapt the device to personal preferences.

While the EBS is not difficult to use, specific training and practice is required for the user to use it effectively in an emergency situation.

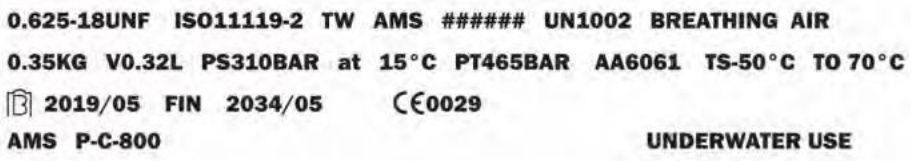
GENERAL DESCRIPTION

The EBS is comprised of a cylinder of compressed air with an integrated cylinder valve and pressure regulator designed to interface with the user and deliver air at a reduced pressure suitable for breathing. When fully charged to maximum operating pressure of 310 bar (4500 psi), the cylinder has the capacity to deliver 89 L (3.2 cu ft) of air at atmospheric pressure.

CYLINDER

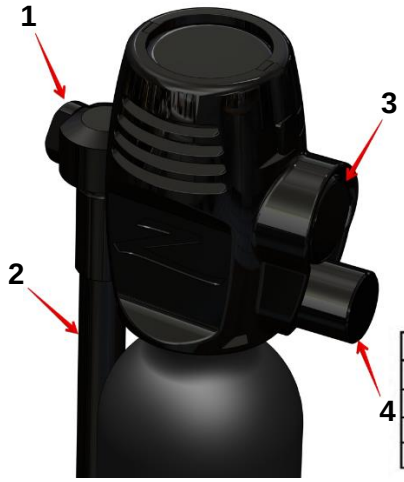
A carbon composite reinforced AMS Type 3 cylinder is used to store compressed air for delivery to the user. It complies with ISO 11119-2 standards for certification and has a maximum working pressure of 310 bar (4500 PSI).

All cylinders shipped with the Defender EBS are EU approved and labeled as follows in compliance with EU standards.

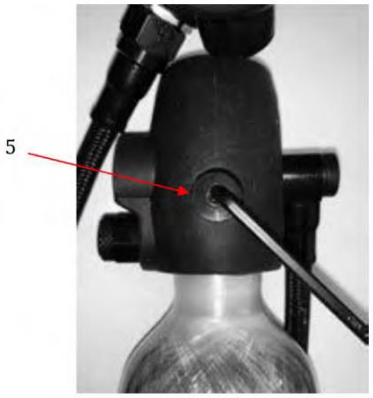


THE EBS FIRST STAGE

The first stage regulator integrated with a cylinder valve is threaded directly into the cylinder to create a more compact package. The first stage delivers breathable AIR pressure to the second stage for breathing. Additionally, the first stage utilizes a compact onboard pressure gauge, low pressure hose with swivel, on/off port, and fill port.



1	LP HOSE SWIVEL
2	LP HOSE
3	PRESSURE GAUGE
4	FILL PORT
5	ON/OFF PORT



The first stage regulator integrated with a cylinder valve can simply be turned on or off manually by hand and is available in two different configurations, either a hand operated ON/OFF knob or an option that requires a 3 mm hex tool to operate the ON/OFF port.

The EBS must be in the ON position in order for air to flow to the user. On/Off valve is turned counterclockwise approximately a full rotation in order to allow air to flow through the unit and breaths to be drawn.

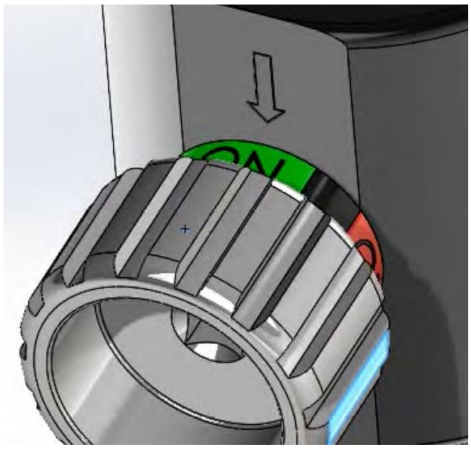
Selection of the OFF position by turning the On/Off valve clockwise until it stops, will prevent air flow to the user. This generally applies to maintenance activity or when the EBS is NOT in service and should never be selected when the EBS is to be ready and available for use.

EBS FIRST STAGE WITH ON/OFF KNOB INSTRUCTIONS

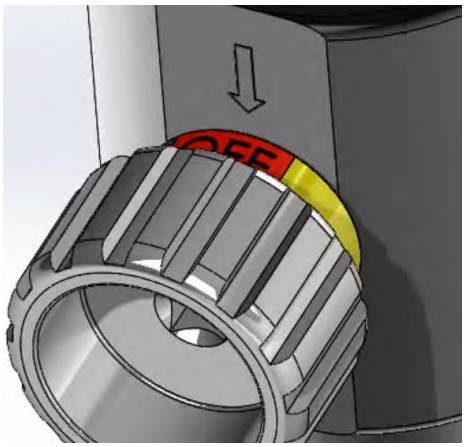
The first stage regulator with an integrated on/off knob is illustrated below. The unit must be in the on position or turned fully in the counterclockwise direction until aligned with green zone and arrow. To turn off, rotate clockwise until the red zone is aligned with the arrow.

See instructions for use in EBS Deployment section of this manual.

ON POSITION



OFF POSITION



NOTE: Do not supply excessive torque when turning the EBS On or Off, as this may damage internal components.

NOTE: The high-pressure port, pressure gauge, and fill port are always active. It is not necessary to operate the on/off knob to fill the cylinder or check the internal pressure.

WARNING: THE EBS IS SHIPPED IN THE "OFF" POSITION WITH AN EMPTY CYLINDER. FAILURE TO ENSURE THAT THE EBS IS "ON" AS DESCRIBED ABOVE AND CYLINDER IS FULL WILL RENDER THE EBS INCAPABLE OF DELIVERING AIR TO THE USER. NEVER TURN OFF THE AIR SUPPLY EXCEPT FOR TAKING UNIT OUT OF SERVICE OR REPAIR.

Each first stage has an individualized serial number engraved on the top of the first stage cap.

THE EBS SECOND STAGE

The second stage regulator with an integrated mouthpiece is connected to the first stage by means of a flexible hose with a swivel connection. Its purpose is to provide a means to connect with the user's mouth and supply air on demand for breathing. See instructions for use in EBS Deployment section of this manual.

The second stage assembly also provides a location for storage of a nose clip to assist with breathing control and a purge cover cap to prevent accidental operation of the purge function when the EBS is in transit or otherwise not in service and ready to use.

With the on/off knob turned on, the second stage of the regulator assembly receives breathing AIR at an intermediate pressure of approximately 9.5 bar / 135 psi from the first stage and delivers it to the user at ambient pressure during inhalation.

DO NOT TEST THE OPERATION OF THE EBS WITHOUT ENSURING THAT THE SYSTEM CAN BE RE-FILLED TO ITS MAXIMUM WORKING PRESSURE IMMEDIATELY AFTER THE TEST, AND BEFORE IN-SERVICE PLACEMENT.

The mouthpiece is indexed to allow for ideal orientation and hose routing when using different mounting configurations. A service technician may adjust this simply by removing the tie wrap, repositioning the mouthpiece, then reinstalling a new tie wrap.

Remove the second stage purge cover before operational use.

ITEM #	DESCRIPTION
1	NOSE CLIP
2	MOUTHPIECE
3	NOSE CLIP TAB
4	EXHAUST VALVES
5	PURGE COVER CAP

EBS PREPARATION FOR IN-SERVICE USE

CYLINDER PRESSURE - The EBS is required to be filled prior to use. Cylinder pressure to be 300 to 310 bar (4351 – 4500 psi) to be fully charged. Refer to the Cylinder Filling Procedure contained in this manual.

FIRST STAGE ON/OFF PORT - The port/valve must be in the ON position at all times when the EBS is in service and ready to use.

SECOND STAGE FEATURE - The mouthpiece orientation is adjustable but should only be changed by a trained service technician. It may be indexed to the user's preference, but only as a maintenance option and may not be changed while the unit is in service for immediate use.

SECOND STAGE PROTECTIVE COVER - This device is intended for EBS transit or storage only. It MUST NOT be installed anytime the EBS is placed in service and ready for use.

DEPLOYMENT OF EBS IN EMERGENCY SITUATION

1. Use one hand to secure your position at the nearest exit escape route. Use your free hand to grasp the EBS second stage regulator and pull out and away from your body to ensure hose is free from entanglement.

2. Place your mouth over the mouthpiece and exhale providing a puff of air to clear residual water that might be inside the second stage housing. Then inhale, lightly at first to be sure residual water is not present, and then continue to breathe normally. If there is water present after first exhalation, block the air path in the mouthpiece with your tongue and press the purge feature on the front of the second stage housing to clear residual water and then continue to breathe normally, recognizing that the air supply is limited and expedient travel to the surface is required.

DO NOT HOLD YOUR BREATH. BREATHE NORMALLY. FAILURE TO EXHALE LIGHTLY AND CONTINUOUSLY OR BREATHE UNINTERRUPTED AS YOU ASCEND FROM EVEN SHALLOW DEPTHS CAN CREATE A HAZARDOUS PRESSURE IMBALANCE IN THE LUNGS RISKING RESPIRATORY DAMAGE, WITH THE POSSIBILITY OF SERIOUS INJURY OR DEATH.

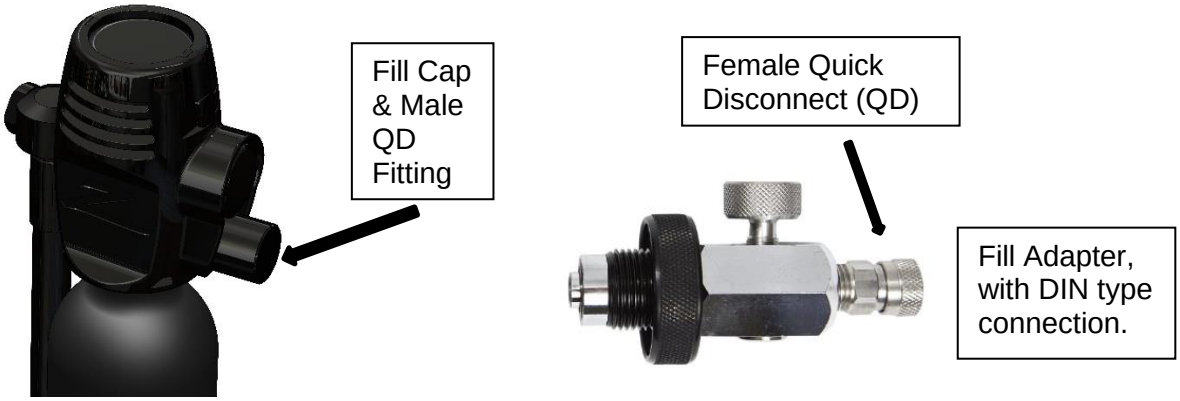
3. Immediately after you have control of the mouthpiece in your mouth, use your free hand to locate and grasp the Nose Clip that is secured to the second stage housing. Pinch the Nose Clip tabs together pull away from the second stage and place it over the nose and release. The purpose of the Nose Clip is to block entry of water into the nose while breathing. Do not try to breathe through the nose while submerged.

4. Note that the EBS is designed to deliver air only when you attempt to inhale. When you stop inhaling, air flow ceases allowing you to comfortably exhale. Air flow can be manually activated anytime by pressing the purge feature, as long as there is a remaining air supply in the cylinder.

5. After you reach the surface and have access to air, discontinue use of the EBS. Once the EBS has been deployed for either an emergency or training it must be removed from service, no longer available for emergency use until after it has been recharged or received periodic maintenance.

FILLING THE CYLINDER

Connection to a compressed air supply to charge the EBS requires a specific Filler Adapter. It is a compressor accessory for the air supply facility and is not supplied * as part of the EBS assembly.



Fill Adapter Assembly (includes Female Quick Disconnect (QD) Connector) is available from Zeagle. Part Number 330-9420. Note: Fill Adapter DIN connection option for attaching to the High-Pressure supply is acceptable. The YOKE type (CGA) connector option is limited to a maximum pressure of 232 bar (3364 psi) and is not suitable for the greater pressure required to fully charge the cylinder.

When compressed air is introduced into the cylinder heat is generated. The amount of heat is related to how rapidly the cylinder is filled. In order to prevent overheating the cylinder the fill rate must be limited.

Composite cylinders such as that used with the EBS can tolerate a limited amount of heat exposure if they are well maintained and undamaged, but the presence of heat interferes with reaching the full volumetric capacity of the cylinder at 310 bar with the cylinder at 21°C (70°F) If the cylinder is filled to 310 bar at a higher temperature, after filling has stopped and the cylinder cools, the pressure will reduce, and the charge will not be at full capacity. Slow filling is preferred and is limited to a recommended rate of not greater than 28 bar (400 psi) per minute. This will greatly reduce the generation of heat and will require about 11 minutes to reach full capacity.

⚠ **DO NOT EXPOSE A YOKE TYPE (CGA) FILL ADAPTER TO A PRESSURE GREATER THAN 232 bar (3364 psi). IT IS NOT RATED FOR THE HIGHER PRESSURE AND COULD LEAD TO DAMAGE EXPOSING THE OPERATOR TO THE RISK OF SERIOUS OR DEATH.**

DO NOT ATTEMPT TO FILL THE EBS CYLINDER WITH ANY GAS OTHER THAN BREATHING AIR THAT CONFORMS TO EN12021 OR THE EQUIVALENT CGA GRADE E STANDARD. INTRODUCTION OF OTHER GASES INCLUDING ENRICHED AIR NITROX (EAN) IS PROHIBITED. HANDLING OF OXYGEN-ENRICHED AIR REQUIRES SPECIALIZED TREATMENT OF INVOLVED EQUIPMENT AND IF NOT PERFORMED PROPERLY, COULD CREATE A HAZARD WITH A POSSIBLE RISK OF SERIOUS INJURY OR DEATH.

DO NOT EXCEED THE MAXIMUM WORKING PRESSURE OF THE EBS CYLINDER AT 310 BAR (4500 PSI) FOR ANY REASON. DOING SO COULD DAMAGE THE CYLINDER, BURST DISK OR OTHER COMPONENTS. USE THE FILL STATION CALIBRATED PRESSURE GAUGE TO MONITOR CYLINDER PRESSURE AS IT IS GENERALLY MORE PRECISE THAN THE EBS ON BOARD GAUGE. CYLINDER PRESSURE AND FILLING RATE MUST BE CONSTANTLY MONITORED TO ENSURE THE MAXIMUM WORKING PRESSURE IS NOT EXCEEDED.

WARNING: FILL RATES MUST NOT EXCEED THE RECOMMENDED RATE OF FILLING PER THE CYLINDER MANUFACTURER'S RECOMMENDED GUIDELINES. EXCEEDING MANUFACTURER'S FILL RATE, MAXIMUM WORKING PRESSURE OR OVERHEATING CAN RESULT IN SERIOUS INJURY OR DEATH. ACCORDING TO THE CYLINDER MANUFACTURER, FAST FILLING IS ACCEPTABLE PROVIDED THE CYLINDER IS WELL MAINTAINED AND UNDAMAGED AND THE FILL RATE DOES NOT EXCEED 30 L PER MINUTE. FOR THE EBS THIS IS EQUIVALENT TO A MAXIMUM COMPRESSION RATE OF 94 BAR (1350 PSI) PER MINUTE, REQUIRING 3.5 MINUTES TO ACHIEVE A FULL CHARGE.
SLOW FILLING AT A RATE NOT TO EXCEED 28 BAR PER MINUTE IS PREFERRED.

TO FILL THE EBS CYLINDER PERFORM THE FOLLOWING PROCEDURE:

1. Turning counterclockwise, remove the Fill Cap from the Male QD Fitting.
2. Ensure that the Male QD Fitting is free of moisture, corrosion and debris. Clean as needed.
3. Attach the clean Female QD of the Fill Adapter to the EBS Male QD Fitting, ensuring it is correctly secure.
4. Operate the valve located on the compressor fill whip to begin introduction of air into the cylinder. Slowly fill the cylinder.
5. After filling is complete, close the fill whip control valve, open the bleed screw to remove residual pressure and operate the Female QD to separate from the EBS Male QD fitting.
6. Replace the Fill Cap and tighten until snug.

CAUTION: Rapid filling will result in incomplete cylinder fills. Use slow fills and cool-down rest periods during filling operations.

CARE AND MAINTENANCE

TRANSPORT AND STORAGE

If possible, transport the EBS assembly (preferably dry) in a padded carrying case or equipment bag separated from sharp items that might damage or scratch the components.
You should also protect the second stage from damage from heavy objects. If the EBS is going in for maintenance, install the second stage purge cover after the EBS has been allowed to dry. Installation of the cover protects against accident purge operation and can signify it is out of service and not available for use.

AFTER EACH TIME THE UNIT IS SUBMERGED:

- If possible, immerse the entire assembly in a warm freshwater bath and soak for one hour, preferably while pressurized.
- Flush the ambient openings and the exterior of all components thoroughly to remove dissolved salt and other contaminants.
- Flush the second stage with running water into the mouthpiece and out the exhaust ports. **DO NOT** depress the purge button (if not pressurized) while rinsing, doing so will allow water to enter the first stage.
- Remove from the freshwater bath and dip all components of the breathing assembly in a bath of Edwards-Councilor Steramine Sanitizing Tablets® (Sanitabs). Use 1 Gal / 3.8L of water per tablet. Do not rinse with fresh water after immersion in sanitizing bath.
  - Miltons tablets are a suitable alternative to Steramine Sanitizing Tablets. If choosing Miltons tablets, please follow instructions as provided for recommended cleaning protocols.
- If possible, lay the complete assembly flat in a cool, dry place (out of direct sunlight) and allow the components to dry naturally.
- **DO NOT** inject or spray lubricants into or onto the first and second stages. Doing so can attract contamination that may subsequently interfere with proper operation.

WARNING: DO NOT REMOVE THE PURGE BUTTON YOURSELF. IMPROPER REPLACEMENT OF THE BUTTON COULD RESULT IN AN UNEXPECTED AND UNDESIRABLE SHUT OFF OF AIR DELIVERY WHILE UNDERWATER.

PRIOR TO STORING THE EBS:

- Ensure that the complete assembly is clean and dry.
- If circumstances prevented cleaning of the EBS prior to transport, or if it became exposed to other contaminated or wet conditions or equipment that was not thoroughly cleaned prior to transport, clean it thoroughly and allow it to dry naturally as previously described.

PERIODIC MAINTENANCE AND SERVICE

As with any equipment that may be called upon for assistance in an emergency, the readiness of the equipment to perform as intended is crucial. It is extremely important that your organization has and follows a plan that prescribes the frequency of inspection and servicing to ensure the EBS condition has not been compromised such that its ability to perform is in jeopardy. At any time during the handling or observation of the EBS there is evidence of loss of pressure or physical damage to the unit, it must be taken out of service and inspected by an authorized service technician.

Operational units require an annual inspection of the EBS, by a trained technician, to ensure correct operation. They are to be serviced once every 24 months (2 years). Your complete EBS assembly must be inspected and serviced by an authorized technician using ONLY Zeagle or Huish Outdoors supplied parts and service kits. Service to include comprehensive inspection and disassembly, cleaning, and adjustment. The latest Service Manual is available for all trained technicians and can be requested.

The in-service life of the EBS is either 10 years or at the expiration date of the cylinder.

Additional items which need to be replaced during the in-service life of the EBS include the Dial Pressure Gauge and the Low Pressure (LP) Hose. These two items are a 5-year mandatory replacement.

NOTE: More frequent service is required when being heavily used, or in harsh salty environments, deployed in contaminated water or subjected to repeated submersion. If there are any questions about service and technician qualifications, contact Huish Outdoors.

WARNING: DO NOT ATTEMPT TO DISASSEMBLE OR IN ANYWAY ADJUST THE EBS ASSEMBLY WITHOUT PROPER TRAINING AND AUTHORIZATION. DOING SO COULD CAUSE MALFUNCTION WHILE UNDERWATER, RESULTING IN SERIOUS INJURY OR DEATH. IT WILL ALSO VOID ANY APPLICABLE WARRANTY.

Additionally, the cylinder must be inspected periodically in accordance with the rules set forth by your local governing authorities and per manufacturers guidelines. Composite cylinders have a life span, which can be found marked on the cylinder, and are to be removed from service at expiry date.

NOTE: According to the composite cylinder manufacturer, the EBS cylinder must be inspected by an authorized facility for compliance with ISO11623 at five-year intervals from the certification date appearing on the cylinder label.
Further the cylinder must be taken out of service if it has been exposed to a temperature greater than 176°C (350°F) or has received a scratch or scuff on the cylinder body with a depth greater than 0.127mm (0.005 inches), or it has reached its expiry date.
Local rules apply.

Training units must be serviced after no more than 200 uses or every two years, whichever comes first, or after any observation of improper operation or physical damage to the EBS unit. If it is suspected that water or other contaminants has entered the unit, it should be taken out of service and submitted for maintenance. If there are any questions as to the need for maintenance, contact your distributor.