



# **ZEAGLE DEFENDER EBS**

## **EMERGENCY BREATHING SYSTEM USER MANUAL**

PN 350-9300 DEFENDER EBS 310 BAR SYSTEM  
PN 350-9310 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

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## **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 Body0598

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

**EN12021:** This standard specifies the allowable contaminants and component gases that make up compressed 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 a 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. Also in compliance to harmonized standard EN250:2014 - Respiratory Equipment open circuit, self contained, compressed air diving apparatus, requirements, testing and marking.

## 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.

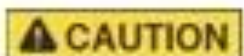
While the EBS is not difficult to use, specific training and practice is required for the user to use it effectively in an emergency situation.

## WARNINGS, CAUTIONS AND NOTES

This manual contains information that could affect your safety. Certain items are emphasized with symbols and signal words to indicate a potential hazard.



Indicates a hazardous situation that, if not avoided or corrected could result in serious injury or death.



Indicates a hazardous situation that, if not avoided or corrected could result in minor to moderate injury.



Indicates information considered important, but not hazardous, relating to possible property damage or malfunction.

**⚠ WARNING**

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.

Proper training is essential for your safety. Training experience must include in- water survival, breathing compressed air underwater and emergency egress from aircraft.

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**

In order to prepare for, use and maintain this device properly, it is essential that you understand all of these aspects through reading this manual and mastering the skills necessary to operate, inspect and maintain it properly. Failure to do so could result in a situation whereby the EBS would not be an available resource to assist with self rescue and possibly lead to serious injury or death.

## 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 delivery 89 L (3.2 cubic feet) of air at atmospheric pressure.


**⚠ WARNING**

The EBS has a limited capacity to deliver air for only a brief period in shallow water (4m;13 ft) 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.

## 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.

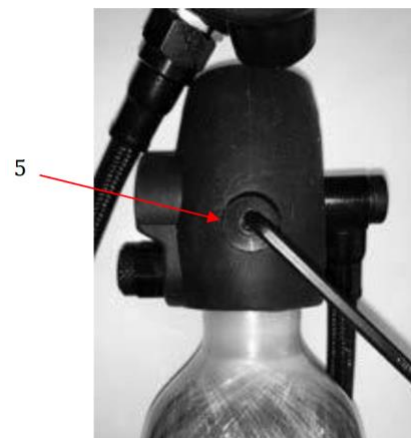
<b>0.625-18UNF ISO11119-2 TW AMS ##### UN1002 BREATHING AIR</b>	
<b>0.35KG V0.32L PS310BAR at 15°C PT465BAR AA6061 TS-50°C TO 70°C</b>	
 <b>2019/05 FIN 2034/05</b>	<b>CE0029</b>
<b>AMS P-C-800</b>	<b>UNDERWATER USE</b>

## EBS FIRST STAGE REGULATOR

The EBS integrated first stage regulator and valve is threaded into the cylinder to provide a compact assembly. It is provided with an onboard pressure gauge, an ON/OFF port, fill port and low-pressure hose with a swivel connection attached to the second stage.



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



The integrated cylinder valve/regulator is available in two different configurations with either a manually-operated ON/OFF port or an option that requires a 3 mm hex tool to operate the ON/OFF selection.

Selection of the OFF position applies to maintenance activity only and should never be selected when the EBS is ready and available for use.

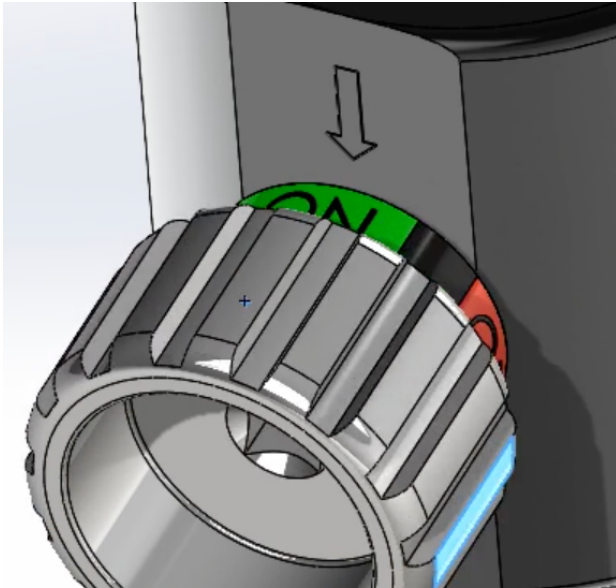
## EBS FIRST STAGE WITH ON/OFF KNOB INSTRUCTIONS

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.

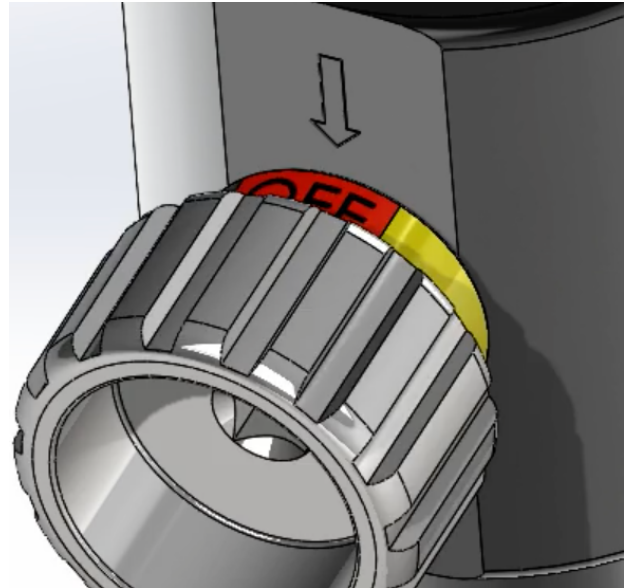
To turn off, rotate clockwise until the red zone is aligned with the arrow.

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

**ON POSITION**



**OFF POSITION**



**⚠ WARNING** The ON/OFF port of the integrated 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 counterclockwise at least one full revolution 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.

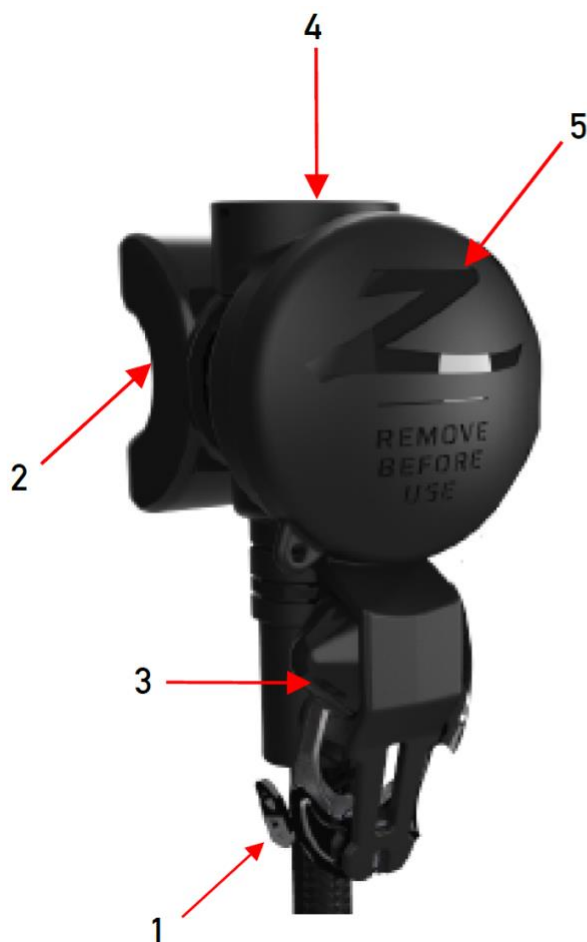


**⚠ WARNING** The ON/OFF port of the integrated valve and first stage must always be in the ON position any time the EBS is in service and ready to be deployed. If the valve has been closed to the OFF position at any time, it must be fully reopened to the ON position by rotating counterclockwise at least one full revolution 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.

## EBS SECOND STAGE REGULATOR

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.



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 delivered from the factory fully charged with the valve in the ON position ready for immediate use. Cylinder pressure must not be less than 310 bar (4500) PSI to be fully charged. If charging is necessary, refer to the Cylinder Filling Procedure contained in this manual.

**FIRST STAGE ON/OFF PORT** - The port 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

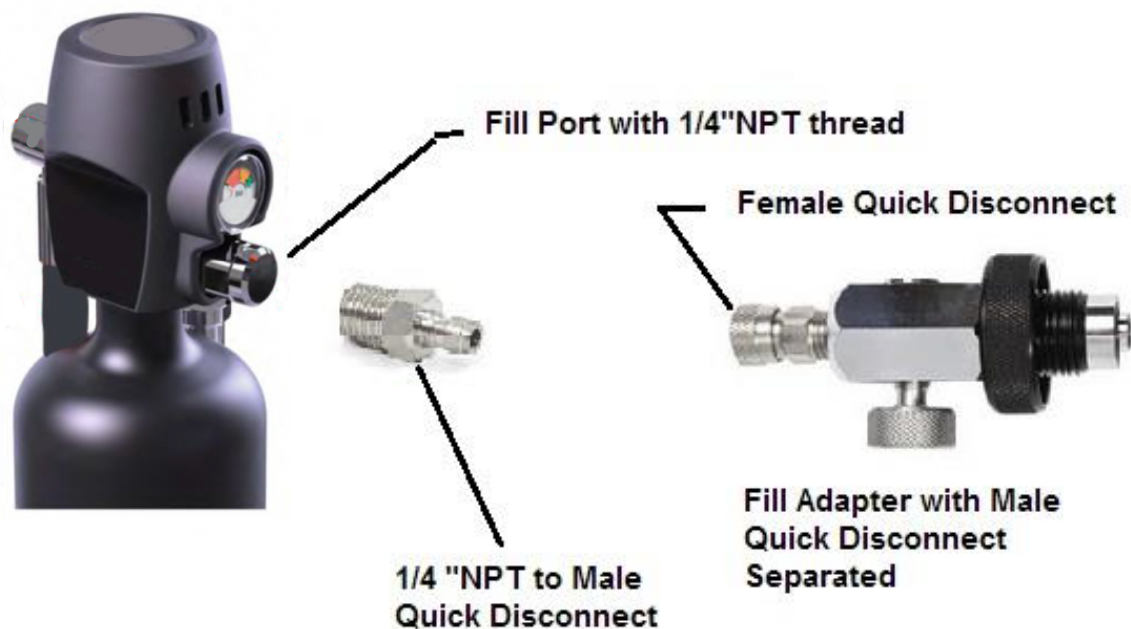
1. Use one hand to secure your position at the nearest exit escape route. Use your free hand to grasp the EBS second stage regulator and pull out and away from your body to ensure hose is free from entanglement.
2. Place your mouth over the mouthpiece and exhale providing a puff of air to clear residual 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.

**⚠ WARNING 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 as shown in the illustration below to open it 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 to you 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.

## CYLINDER FILLING GUIDELINES

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.



Filler Adapter Assembly (includes Male QD Connector) is available from Zeagle. Part Number 330-9420. Note: Fill Adapter DIN connection option for attaching to the HP 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 greater pressure required to fully charge the cylinder.

**⚠ WARNING** 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.

**⚠ WARNING** Do not attempt to fill the EBS cylinder with **any gas other than clean 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.

#### **NOTICE**

**Before connecting the Fill Adapter to the Male QD observe the following information.**

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.



**WARNING** Do not exceed the **maximum working pressure** of the EBS at **310 bar** (4500 PSI) for any reason. Use the fill station 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.

Slow filling at a rate not to exceed 28 bar per minute is preferred.

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 less than 3.5 minutes to achieve a full charge.

Exceeding the maximum pressure and fill rate could result in damage to the EBS and create a hazardous condition with the possibility of serious injury or death.

To Fill the EBS cylinder perform the following procedure:

1. Remove the Fill Port Cap turning counterclockwise.
2. Inspect the fill port passage and remove any moisture, corrosion or debris.
3. Insert the Male QD adapter of the Filler Adapter assembly into the EBS fill port turning clockwise by hand until snug.
4. Operate the valve located on the compressor fill whip to begin introduction 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 the Fill Adapter from the EBS.
6. Remove the Male QD Adapter from the Fill Port. Replace the Fill Cap and tighten until snug.

## CARE AND MAINTENANCE

### Transport and Storage

Whenever possible the EBS should be dried and placed in a padded carrying or equipment bag for transport and storage. Care should be taken to avoid exposure of the EBS to sharp or heavy objects that might scratch or otherwise damage the unit. Whenever the EBS is removed from service and after drying, install the Second Stage Protective Cover. Installation of the cover protects against accident purge operation and signifies it is out-of service and not available for use.

### Cleaning after use and exposure to submergence in water

- If possible, immerse the entire EBS in a warm, clean freshwater bath and soak for one hour, preferably while still pressurized and with the ON/OFF port in the ON position. If pressure is not available, DO NOT operate the purge function while the unit is submerged or being rinsed. Such action can cause water and other contaminants to enter the EBS requiring further service.
- Flush the exterior and accessible interior with clean freshwater to remove sea salt and other contaminants. Be sure mouthpiece and exhaust valves are included in flushing operation.
- Following rinsing, dip the second stage in a sanitizing bath as prescribed below.

Dissolve one Edwards-Councilor Steramine Sanitizing Tablet per 3.8 L (1 Gal) of freshwater per manufacturer's instruction. Miltons tablets are an acceptable alternative provided that use is consistent with Milton's instruction and cleaning protocol.

- Do not rinse again after exposing unit to sanitizing bath. Just allow it to dry. If possible, place the entire EBS Assembly on a cool, flat surface not exposed to direct sunlight to dry.

#### **NOTICE**

Do not inject or spray lubricants or other chemicals into the EBS first or second stages or on to external surfaces. It is not necessary and may attract contaminants that may later interfere with proper operation.

#### **⚠ WARNING**

Do not remove any parts of the EBS for routine rinsing, including removal of the purge cover. Improper reassembly could result in interference with proper operation of the EBS and could result in unexpected loss of air delivery while underwater.

### Prior to storing the EBS:

- Ensure that the unit is completely dry and clean.

- If circumstances prevented cleaning of the EBS before transport, or if it became exposed to wet or unclean conditions it must be subjected to the cleaning procedure described above before being returned to storage.

## 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. Therefore it is extremely important that your organization have and follow 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. Needs vary from one organization to another and the proper interval for inspections is at the discretion of your safety officer. However, at a minimum, the following should be performed.

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.

**NOTICE** 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).

**Operational units** must be serviced at least annually. Service may include comprehensive inspection and disassembly, cleaning and adjustment.

**WARNING** Disassembly of the EBS is to be done only by a technician that has received training and authorization to service the EBS, using Zeagle or Huish Outdoors supplied parts only.

Do not attempt to disassemble the unit without training and authorization. Such activity could lead to a serious malfunction of the unit resulting in a loss of air delivery in a critical situation, possibly leading to serious injury or death.

**Training units** must be serviced at least annually, after not more than 200 uses 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.