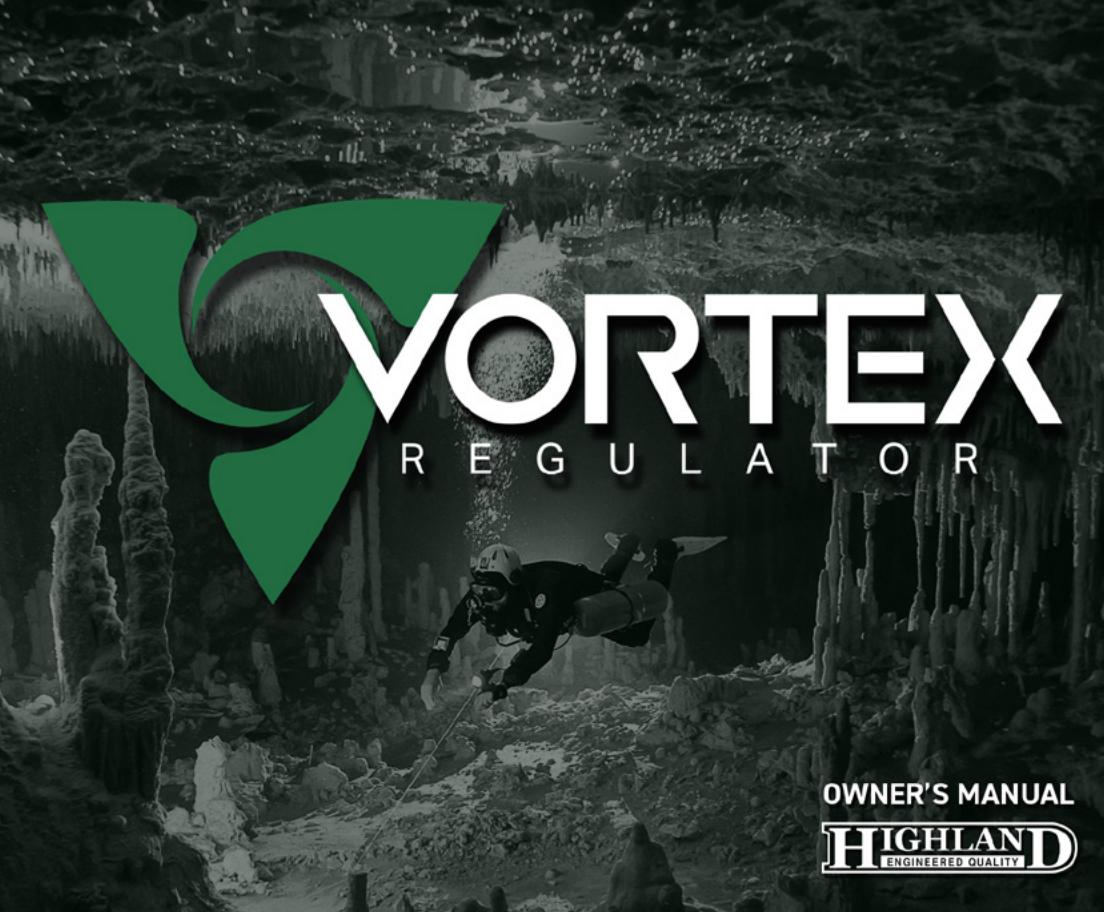
VORTEX
REGULATOR
OWNER'S MANUAL
HIGHLAND
ENGINEERED QUALITY

Table of Contents

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Introduction

Thank you for placing your trust in the Highland Vortex Regulator. As with other Highland* diving products, we have designed this regulator to appeal to a more serious diver, perhaps the type of diver that enjoys diving deeper, in overhead environments or colder waters.

Your Vortex Regulator has been built, and tested, to the highest standards. It is the result of quality engineering, material selection and precise assembly methods. Each Vortex regulator is 100% tested prior to final packaging so that you know it works right the first time you breathe it.

With proper care and maintenance, your Highland Regulator will continue to deliver its factory-new performance for many, many years to come.

Highland is a brand of technical diving products found within XS Scuba family of fine products.

Warnings, Cautions and Notes

It is important to pay special attention to the information provided in warnings, cautions and notes, which are accompanied by the following symbols:

A **WARNING** indicates any situation that, if not avoided, could result in serious injury or death.

A **CAUTION** indicates any situation or technique that could cause damage to the product, and could subsequently result in injury to the user.

A **NOTE** is used to emphasize important points, tips, and reminders.

General Precautions and Warnings

WARNING: Before using this regulator, you must have successfully received training and certification in the technique of SCUBA diving from a recognized training agency (or any Military or government operated diving school). Use of SCUBA equipment by uncertified or untrained persons is dangerous and can result in serious injury or death.

WARNING: Keep your regulator in good working condition by having it serviced annually at an authorized Highland / XS Scuba Dealer. Service, disassembly or adjustment must not be attempted by persons who are not properly trained to work on this regulator.

WARNING: This regulator has multiple freeze-resistant features on it, which allow it to be safely used in water that is colder than 50°F / 10°C. This model has been tested in water temperatures down to 39°F / 4°C.

If you are diving in water temperatures below 50°F / 10°C, you must have successfully completed cold water specialty training from a recognized training agency (or any Military or government operated diving school). Diving this regulator in these temperatures without cold water specialty training can result in a regulator freeze-up, resulting in a rapid loss of your breathing gas supply.

WARNING: DO NOT leave the cylinder standing unsecured with the regulator attached to the valve. Should the cylinder get knocked over, permanent damage may occur to the regulator and the cylinder valve.

WARNING: DO NOT use the regulator first stage as a carry handle when lifting or transporting the cylinder as this can damage the regulator and / or the cylinder valve.

WARNING: Always pressurize the regulator gradually by opening the cylinder valve SLOWLY. This is especially true when using nitrox as your breathing gas.

WARNING: This regulator is not configured for commercial use with surface supplied air.

Enriched Air Nitrox Use

WARNING: This section contains important information regarding the use of this regulator with enriched air nitrox. Do not use this regulator with enriched air nitrox if you do not fully understand this section. To do otherwise puts you at risk of serious injury or death.

WARNING: Obtain an enriched air nitrox diving certification. In order to fully understand the risks involved with diving elevated percentages of oxygen (above 21%), you must obtain a certification in enriched air nitrox from a recognized training agency.
Your Highland regulator has been prepared for use with enriched air nitrox (EAN) where the oxygen percentage does not exceed 40% (EAN40). This is because your regulator was built to a high standard of cleanliness using EAN compatible parts and lubricant.

If it is your intention to use your new XS Scuba regulator with EAN up to 40%O2, it is critical that you maintain the internal cleanliness of your regulator (see section on Care and Maintenance).

If it is your intention to use your regulator interchangeably with breathing air, the breathing air should be “oxygen-compatible” or “hyper-filtered” whereas the condensed hydrocarbons in the air do not exceed 0.1mg/m3. Your local Highland / XS Scuba Dealer can help you determine whether the breathing air they provide condensed hydrocarbons in the air do not exceed 0.1mg/m3. Your local Highland / XS Scuba Dealer can help you determine whether the breathing air they provide meets this criterion.

Standard compressed breathing air, often referred to as “Grade E” does not necessarily meet this criterion. Grade E breathing air may contain certain levels of hydrocarbons, including traces of compressor oils, that while not considered harmful to breathe, can pose a risk in the presence of elevated oxygen content.

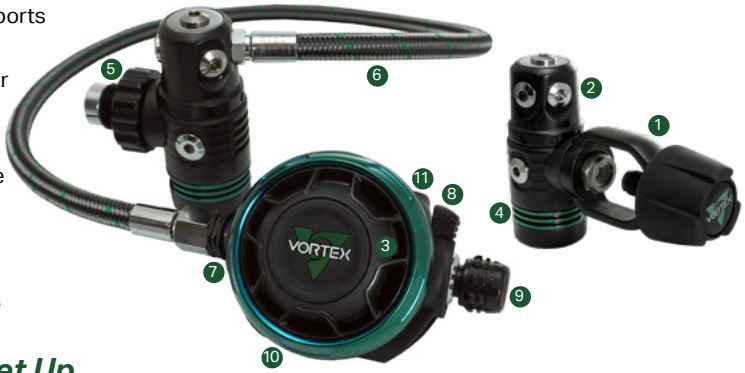
Passing hydrocarbons through a valve and regulator creates a cumulative effect where the hydrocarbons build up over time along the internal passageways of the equipment. When these hydrocarbons come in contact with high pressure oxygen enriched air, they can pose a very real hazard that can lead to combustion.

Therefore, if a regulator has been used with Grade E breathing air, it should receive overhaul service, including hydrocarbon cleaning, prior to being put back into nitrox service.

Although second stage components are not subjected to high pressure EAN, XS Scuba recommends that the same guidelines apply.

Your Regulator at a Glance

1. Yoke / Knob connector
2. Rotating turret w/ 5MP ports
3. 2 HP ports
4. 1st stage heat exchanger
5. DIN Connector
6. Miflex braided hose
7. 2nd stage heat exchange
8. Venturi lever
9. Inhalation control knob
10. Purge cover
11. Comfy-bite mouthpiece



Preparation and Set Up

Your regulator has 2 high pressure ports and 5 medium pressure ports to attach your various accessories. The high pressure port is where you would attach your submersible pressure gauge, console, transmitter or air-integrated computer. Medium pressure ports are for your primary and alternate second stages, BC inflator hose and possibly a drysuit inflator hose. The addition of a 5th medium pressure port optimizes hose routings when using twin cylinder set-ups.

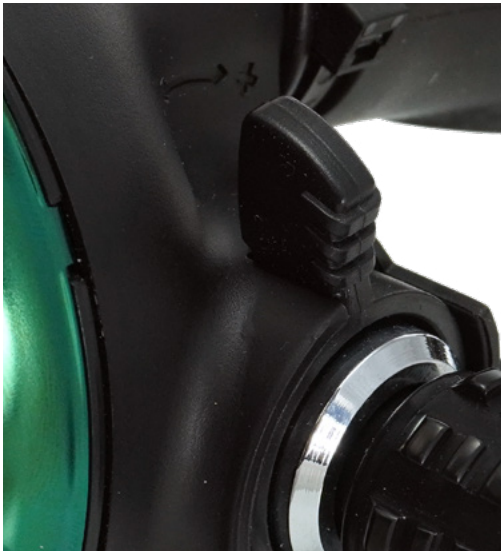
⚠ **CAUTION:** XS Scuba recommends that you have your XS Scuba Dealer install your accessory items to prevent over-torquing the hose fittings and to optimize placement of accessory hoses.

FEATURES

Venturi Lever

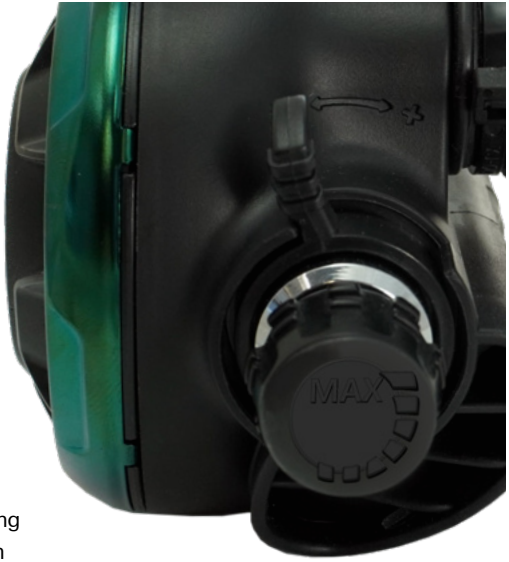
You will notice a lever on the side of the second stage opposite the hose connection. Moving this lever back and forth changes the direction of the air internally in the second stage. When pulled back, towards your mouth, to the plus "+" setting, the air flow creates a "venturi" effect which creates a nice boost in breathing performance. When moved forward, away from the mouth, to the minus "-" setting, the venturi effect is interrupted which increases your breathing effort. The deeper you go, the more noticeable this becomes.

It is important to note, that when the lever is on the plus "+" setting and the regulator is out of your mouth, the second stage can get bumped and go into a freeflow condition. Should this happen, just move the lever to the minus "-" position and the freeflow will stop.



NOTE: The simplest way to use this performance feature is to place the lever in the plus "+" position when the regulator is in your mouth and move it to the minus "-" position when it is out of your mouth.

Inhalation Control Knob



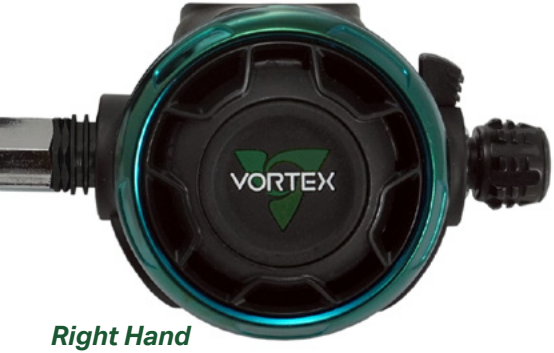
The Inhalation Control Knob, located next to the venturi lever, adjusts the effort required to initiate each inhalation cycle. As it is turned in (clockwise), the opening effort will increase.

Turning the knob out (counter-clockwise) will decrease the opening effort to make breathing easier. Sometimes, when turned out all the way, a slight hissing (air leak) may be heard. If this occurs, turn the knob in (clockwise) just enough to stop the hissing.

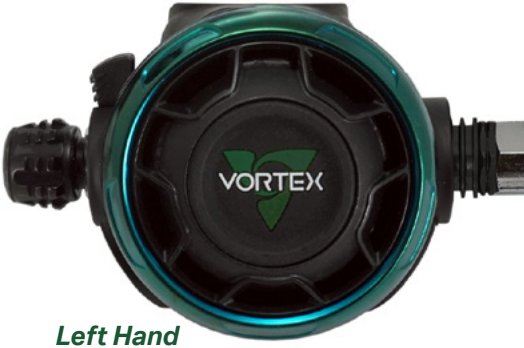
The Inhalation Control Knob is particularly useful at deeper depths, or in variable conditions that affect the opening effort of the second stage, such as facing into strong currents or while using a diver propulsion vehicle (DPV). It will also allow compensation for a difference in the hydrostatic pressure between your second stage and the center of your lungs, such as when you are in a head-down position. You can use the Inhalation Control Knob to tune your regulator to maintain its peak performance throughout the course of your dive, or you can leave it set in its mid-range position and dive with as you would any non-adjustable second stage.

Reversibility

The Vortex second stage is a reversible second stage. It comes in a right hand (RH) configuration with the hose entering it from the right when it is in your mouth. However, a trained Highland Technician, using a LH/RH Reversal Kit, p/n RPH650, can reverse it so that the hose comes in from the left when it is in your mouth. This can be a useful feature offering much greater flexibility for various kit configurations.



Right Hand



Left Hand

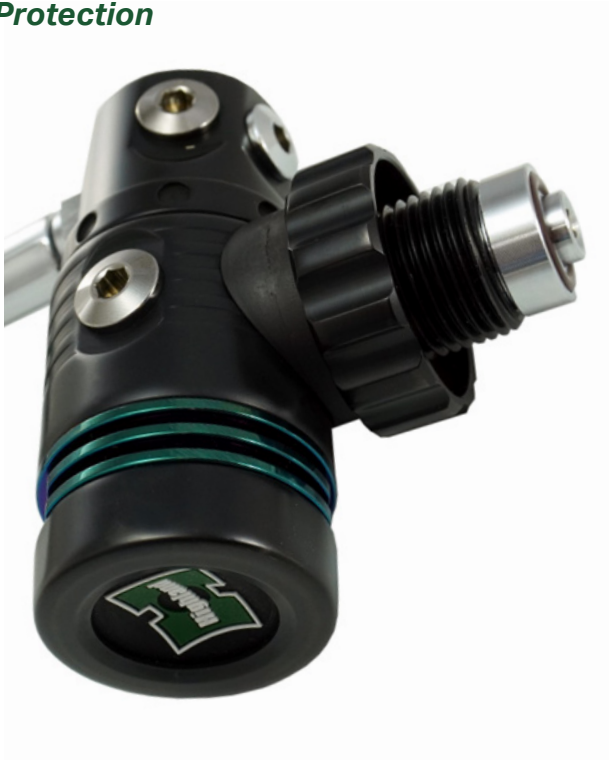
⚠ **WARNING:** A RH/LH conversion must only be performed by an Authorized Highland Regulator Technician. Disassembly, adjustment, or repair must not be attempted by persons who are not factory trained and authorized by Highland.

First Stage Environmental Protection

Diaphragm first stages have an ambient chamber where waters enters so that ambient pressure can transfer to the main diaphragm. In cold water, it is possible for ice to form in this chamber, interfering with normal operation of the regulator.

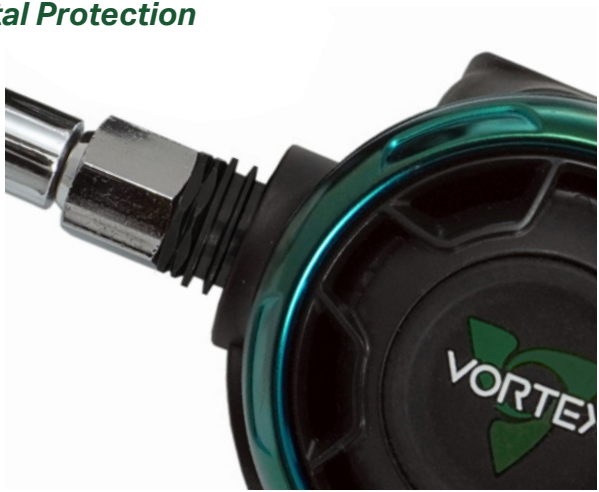
The Highland Vortex features an environmental dry system, which seals off the ambient chamber and prevents water from entering it. It is comprised of an external, secondary diaphragm and a unique piston which transfers ambient pressure from the external diaphragm to the internal, main diaphragm.

While this environmental dry system is effective at preventing ice build up inside the first stage, it does not prevent ice from forming in the second stage.



Second Stage Environmental Protection

Even though you may be diving in cold water, the breathing gas entering your second stage is even colder! Without proper technique, there is a chance that the second stage regulator can freeze up. To minimize this possibility, the Highland Vortex Regulator has a heat exchanger, or heat sync, which surrounds the second stage valve. This part allows the warmer ambient water to "heat" the second stage valve, while allowing the cold from the valve to dissipate into the surrounding water. The result is an increased resistance to freezing.



⚠ **WARNING:** This regulator has multiple freeze-resistant features on it, which allow it to be safely used in water that is colder than 50°F / 10°C. This model has been tested in water temperatures down to 39°F / 4°C.

If you are diving in water temperatures below 50°F / 10°C, you must have successfully completed cold water specialty training from a recognized training agency (or any Military or government operated diving school). Diving this regulator in these temperatures without cold water specialty training can result in a regulator freeze-up, resulting in a rapid loss of your gas supply.

Attaching the First Stage to a Cylinder Valve – Yoke Connection

Partially loosen the yoke screw to remove the dust cap.

Vent a small amount of air from the cylinder valve to blow out any dust, debris or moisture.

Inspect the condition of the cylinder valve-oring. Replace if damaged or missing.

Place the regulator's connection yoke over the valve so that the inlet fitting of the regulator seats against the valve's o-ring AND the primary second stage hose routes over the diver's desired shoulder. Hold in place while you turn the yoke screw clockwise until snug. Confirm that the yoke screw engages the small dimple on the back of the cylinder valve.

⚠ **CAUTION:** Over-tightening the regulator on the valve can cause damage and make it difficult to remove the regulator after the dive. It is the valve o-ring that forms the seal, not excessive tightening of the yoke screw.

Attaching the First Stage to a Cylinder Valve – DIN Connection

Vent a small amount of air from the cylinder valve to blow out any dust, debris or moisture.

Inspect the o-ring at the leading edge of the DIN connector. Replace if missing or damaged.

Line up the regulator's DIN connection with the valve inlet. Be certain that the primary second stage hose routes over the diver's desired shoulder. Thread the DIN connector into the cylinder valve and tighten by hand until snug. DO NOT use a tool to tighten.

⚠ **CAUTION:** Over-tightening the regulator on the valve can cause damage and make it difficult to remove the regulator after the dive. It is the DIN connector o-ring that forms the seal, not excessive tightening of the DIN handwheel.

Pressurizing Your Regulator

Place the venturi lever in the minus "-" position. Turn the inhalation control knob, clockwise, all the way inward.

Make sure that your pressure gauge, or air-integrated computer, faces away from you.

Pressurize the regulator by SLOWLY opening the cylinder valve. Continue to open the valve all the way.

⚠ **WARNING:** When opening your cylinder valve to pressurize your regulator, open the valve SLOWLY. This will minimize the generation of heat. Failure to do so while using elevated percentages of oxygen, increases your risk of combustion, which can lead to serious injury or death.

Listen for leaks near both stages of the regulator, any accessories and along the length of the hoses. If there is air leaking between the regulator and the cylinder valve, follow the procedures for removing the regulator from the valve. Replace the valve o-ring and reseat the regulator. If leakage persists, return the regulator with cylinder to your local Highland / XS Scuba Dealer for inspection and repair.

⚠ **WARNING:** Do not dive if your regulator or its accessories are leaking.

Depress the purge button briefly to ensure sufficient air flow and to blow out any dust or debris. Place the regulator in your mouth. Move the venturi lever to the plus "+" position. Turn the inhalation control knob counterclockwise, all the way out. Then turn it, clockwise, back in until the regulator breathes comfortably for you without being overly sensitive. Inhale and exhale slowly and deeply. The regulator should breathe easily without noticeable resistance.

Diving

If you are making an entry or are surface swimming with the regulator out of your mouth, be sure to set the venturi lever in the minus "-" position and have the inhalation control knob turned all the way in. Once you place the regulator into your mouth, move the venturi lever to the plus "+" for the remainder of the dive. Where you set the inhalation control knob will be based upon environmental conditions as well as your personal preference. See earlier section on the inhalation control knob.

Go ahead, enjoy your dive. If you don't have to think about your regulator during the dive, then we succeeded!

At the end of the dive, when you have arrived at the surface, be sure to return the venturi lever to the minus "-" position and turn the inhalation control knob in before taking the regulator out of your mouth and exiting the water.

Cold Water Diving

European Norms define cold water as 50°F / 10°C or lower. In these temperatures, there is a risk of the regulator freezing up. This risk in increased even more in fresh water vs. salt water. A regulator that freezes up, usually results in a freeflow situation, leading to a rapid loss of your breathing gas.

There are many variables that can lead to a regulator freeze up besides just the water temperature. Other factors include depth, duration, moisture content of the breathing gas, breathing rate, lung volume and most importantly diving technique!

Before attempting to dive in these temperatures, it is important that you and your buddy be properly trained, and certified, in cold water diving procedures. If these procedures are not followed carefully, a regulator freeze up can occur.

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If you are diving in water temperatures below 50°F / 10°C, you must have successfully completed cold water specialty training from a recognized training agency (or any Military or government operated diving school). Diving this regulator in these temperatures without cold water specialty training can result in a regulator freeze-up, resulting in a rapid loss of your breathing gas supply.

Here is a partial list of procedures to reduce your risk of regulator freeze up:

- Protect your regulator from contact with water prior to the dive.
- Protect your regulator from the cold air prior to the dive. Keep your regulator and all its accessories in a warm, dry place.
- Avoid breathing into the regulator, or pressing the purge button, before getting into the water.
- Avoid removing the regulator from your mouth during the dive or while at the surface. This will keep cold water out of the second stage.
- Try to avoid excessive exertion to minimize the volume of air flowing through the regulator.
- Do not continually press the purge button.

Post Dive Procedure

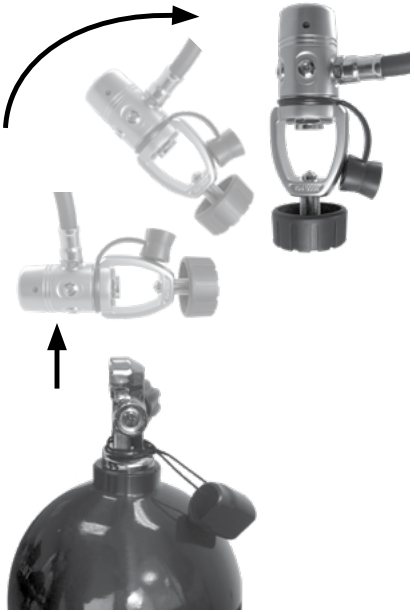
⚠ **NOTE:** If freshwater is readily available, rinse your regulator thoroughly prior to depressurizing it. This will prevent water from entering the first stage.

⚠ **NOTE:** When you remove the first stage from the cylinder, exercise caution not to let any water enter the first stage through the inlet fitting, where the filter is located.

Shut off the cylinder gas supply by turning the cylinder valve handwheel until lightly snug.

Depress the second stage purge button to drain the remaining gas from the regulator and hoses. Keep the purge button pressed in until no more gas can be heard exiting the regulator.

Turn the yoke screw or DIN connector counterclockwise to loosen the regulator on the cylinder valve. While removing the regulator, keep the first stage inverted with the yoke screw, or DIN connector, facing down. This will prevent water drops from going in the inlet area where the filter is located.



Dry the dust cap with a towel and install it over the regulator inlet.

Care and Maintenance

As soon as possible after the dive, it is important to soak or rinse your regulator in fresh water. Warm water (<120°F / 49°C) is best.

The best method is to soak it in a tub of water while it is still connected to the cylinder and pressurized. This keeps rinse water out of the hoses and the first stage.

If this is not possible, then you may soak it while it is depressurized as long as you follow these steps:

• Ensure that the dust cap is making a water tight seal over the regulator's inlet fitting.

• If your regulator has an inhalation control knob, be sure to turn it clockwise, all the way in.

• DO NOT depress the purge button. This will allow water to enter the regulator and make its way down the hose to the first stage.

• Keep the second stage lower than the first stage.

While rinsing, move the venturi lever back and forth several times to remove any salt, sand or contaminants. Rotate the inhalation control knob a few revolutions each direction.

If soaking is not possible, then, as a minimum, rinse with a garden hose. Do not use a high-pressure nozzle as this could compromise the 2nd stage internal parts. Be sure to rinse the inside of the second stage via the mouthpiece as well as the venturi lever and inhalation control knob.

After rinsing, shake any residual water out of the second stage. The inhalation control knob should be turned all the way out (counter-clockwise). This will help extend the life of the low-pressure seat in the second stage valve.

Hang the regulator by the first stage in a cool, dry environment, out of direct sunlight. After your regulator is completely dry, you may store it in a regulator box or bag

⚠ **CAUTION:** DO NOT store your regulator in a hot environment or near an electric motor, which produces ozone. Prolonged exposure to heat, ozone, chlorine fumes or ultraviolet rays can cause premature degradation of your regulator's soft parts and hoses.

Dealer Inspection and Service

Do not assume that your regulator is in good working order because it has received little use since its last servicing. Storage can be hard on a regulator as seals and other soft parts can take a set and dry out.

You must obtain factory authorized service from a Highland / XS Scuba Dealer at least once a year. Your regulator may require more frequent service depending on the amount of use it receives and the type of environmental conditions that it is subjected to.

If the regulator is used for rental or training purposes, it will require factory prescribed service every three to six months. Chlorinated swimming pool water is an especially damaging environment for scuba equipment, due to the high levels of chlorine and pH balancing chemicals that can cause certain components to rapidly deteriorate.

⚠ **WARNING:** Be sure to have your regulator serviced at least once a year by a Highland / XS Scuba Dealer. Your personal safety and the mechanical integrity of your regulator may depend on it.

Warranty

XS Scuba offers a **Limited Lifetime Warranty** against defects in material and workmanship on their regulators. This warranty is limited and subject to the following restrictions:

- The warranty is offered to the original owner only
- The regulator must have been purchased from an authorized XS Scuba dealer.

- This warranty does not cover normal wear. Factory prescribed service by an authorized XS Scuba Dealer is required at least once annually.
- Some parts are subject to wear under minimal or normal use. O-rings, seats, filters, diaphragms, valves, tie wraps, mouthpieces and hoses should be inspected for wear on a regular basis. Replacement of these items is usually necessitated based upon normal wear rather than defects.
- This warranty does not extend to damages caused by improper use, improper maintenance, neglect, unauthorized repairs, modifications, accidents, fire or casualties.
- Cosmetic damage, such as scratches dents or nicks, is not covered by this warranty.
- This warranty does not extend to regulators used for rental, training, commercial or military purposes.
- This warranty is limited to repair or replacement at the discretion of XS Scuba.

NOTE: All warranty transactions must be accompanied by proof of original purchase from and authorized XS Scuba dealer. Be sure to save your sales receipt along with proof of prior annual service.

XS SCUBA DISCLAIMS AND EXCLUDES ANY LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states in the U.S, and some foreign countries do not allow exclusions or limitations of liability for incidental or consequential damages, so this may not apply to you.

For additional information about your regulator be sure to visit www.xsscuba.com. Here you can learn about an optional DIN connection for your regulator, attaching an alternate air source, specifications and more.

ANNUAL SERVICE RECORD

Date	*Dealer's Name*	*Technician's Name*	*Service Performed*


HIGHLAND
ENGINEERED QUALITY