



OWNERS MANUAL

ATOMIC[®]
AQUATICS

Scuba**Heat**

PATENT PENDING

Personal Thermal Protection Device

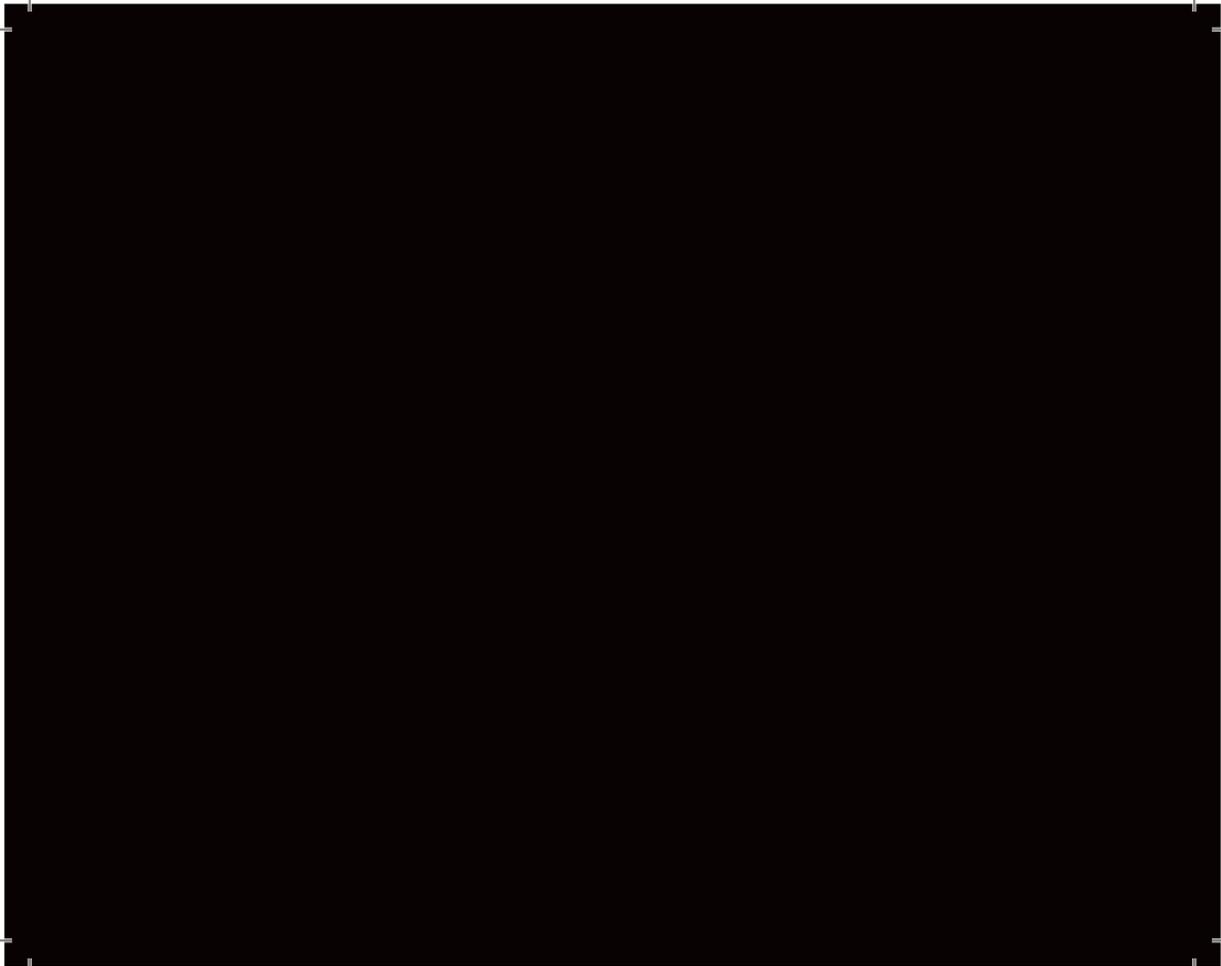


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THANK YOU

...for choosing Atomic Aquatics. Since we introduced the world's first line of Titanium diving regulators in 1997, we have continued our dedication to designing and manufacturing only the finest diving products crafted from the most durable, high-performance materials. The ScubaHeat is an innovative solution to the long standing problem of regulator icing and associated unstable operation when used in cold water conditions. The ScubaHeat can be used on virtually any first and second stage regulator with standard size hose fittings to protect the second stage and provide a warmer, more comfortable dive experience.

⚠ IMPORTANT NOTICE ⚠

Before you dive with this product, please read this manual. It shows you how to set up on your system, proper use and limitations of the device. Keep it for future reference, and information on maintenance, service and warranty.

WARNINGS, CAUTIONS AND NOTES

Certain information presented requires your attention with regard to safety. Use of these symbols indicates the following:

⚠ WARNING: Indicates a situation that may, if not avoided or corrected, result in serious injury or death.

⚠ CAUTION: Indicates a situation that may, if not avoided or corrected result in minor injury or significant damage to the product.

IMPORTANT: Used to direct attention to emphasize an important detail.

⚠ WARNING ⚠

Cold water diving is defined as activity in water temperatures below 50°F (10°C). It requires training that is frequently beyond the typical recreational basic open water certification. Such training must include measures to avoid regulator freezing and the emergency procedures for dealing with an unstable, free flowing regulator. Do not attempt to dive in cold water conditions without mastering the skills required to perform in this environment. Failure to adhere to this recommendation is hazardous and could lead to serious personal injury or death.

SPECIAL NOTE FOR USERS REQUIRING CE CERTIFICATION

ScubaHeat, is a new supplemental device for use with a scuba regulator that warms the breathing air to increase the comfort of your dive and help prevent freezing and the associated problems related to ice formation in the regulator second stage.

Be aware that in certain countries where CE certification is required, when ScubaHeat is installed, the certification for the specific regulator system you are using may no longer be valid. This is because the configuration of the regulator system with ScubaHeat is now changed and not part of the original tested configuration.

INTRODUCTION

ScubaHeat is your personal thermal protection device that warms the cold air exiting your first stage before it enters your second stage. As a heat exchanging device it extracts heat from the surrounding water to warm the super cooled air coming from the first stage before you breathe it. The purpose of ScubaHeat is twofold. Number one is to reduce the likelihood of freezing in the second stage in cold water conditions. Secondly it will keep you warmer by reducing respiratory heat loss and cold stress. It has been known for many years that scuba regulators can freeze and become unstable under certain conditions when used in water temperatures below 50°F (10°C). At temperatures below this threshold and at high breathing loads, the tendency to freeze can occur within a very brief period of operation.

Until now equipment modifications to resolve this problem have been primarily directed to minimize freezing in the first stage of the regulator. Environmental protection treatment of the first stage has demonstrated some effectiveness, but efforts to address second stage freezing have been either nonexistent or ineffective.

The ScubaHeat represents a new approach to the problem and has achieved lab-measured success. The ScubaHeat introduces heat to very cold air exiting the first stage through use of an effective heat exchanger before it enters the second stage, thereby raising the temperature above the freezing point to minimize or eliminate formation of ice in the second stage interior.

Warming the air before it passes through the second stage not only helps maintenance of regulator stability, it also provides additional benefits by slowing the chilling effect on the diver's body from respiration of very cold air. Heat loss experienced by the body from breathing cold air can be significant resulting in cold stress and a reduction in the ability of the diver to perform even simple tasks. The benefits of breathing warmer air available through the use of the ScubaHeat can have a positive effect on reducing cold stress and improving diver performance as well as providing a measure of increased comfort.

The ScubaHeat will fit most any first and second stage regulator that uses standard size hose fittings. ScubaHeat will not prevent freezing of the first stage and should be used with a freeze resistant, environmentally protected first stage certified for cold water use (water temperatures below 50°F or 10°C). Check with the regulator manufacturer to determine whether it is certified for cold water use.

⚠ WARNING ⚠**FIRST STAGE REQUIREMENTS**

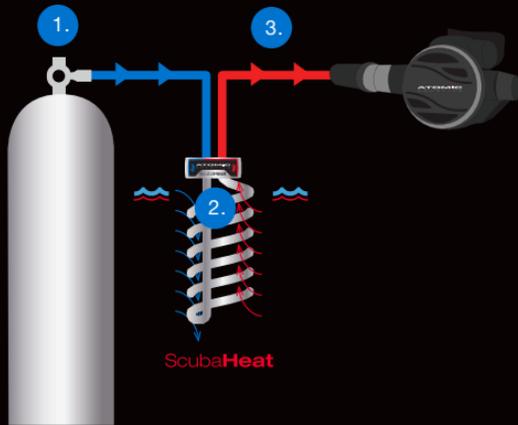
ScubaHeat will not prevent freezing of the first stage and must be used only with a freeze resistant, environmentally protected first stage approved for cold water use (water temperatures below 50°F or 10°C).

For Atomic Aquatics Regulators, when diving in extreme cold waters below 50°F (10°C), we recommend having the first stage sealed with the installation of the optional antifreeze kit (standard in T3, T2x, ST1 & M1). This is a rubber sleeve that fits over the ambient chamber ports of the first stage to prevent icing of the first stage. This is a factory or dealer installed item, as it requires special tools and disassembly of the first stage for filling of the chamber with a special low temperature lubricant.

HOW IT WORKS

HOW IT WORKS

The ScubaHeat is a simple highly effective heat exchanger placed between your first and second stage that warms the air you breathe. No moving parts, heating elements or batteries, it works passively. Thermal protection for both you and your regulator.



1. Rapid expansion cools the gas to temperatures well below freezing at the first stage.
2. The highly effective heat exchanger transfers heat from the surrounding water to the breathing gas in the coil.
3. The diver breathes gas much warmer than directly from the first stage.

Air exiting the tank valve and first stage is extremely cold, due to the rapid expansion of the air under high pressure. The air temperature exiting the first stage will vary depending upon breathing rate, depth and ambient temperature, and is always well below freezing (about -16°F (27°C) and even colder when the regulator is purged. Since the surrounding water temperature is always greater than the air entering the ScubaHeat, the heat can be transferred from the water to warm the colder air before it enters the second stage.

This is what the Scuba Heat does. It collects available heat and directs it where it is needed.

Typically, the air passing through the ScubaHeat entering the second stage will be within a degree of the ambient water temperature. If you are in 34°F degree water, warming the air from -16°F to +34°F is a huge 50°F degree difference, and the effect will be greater at warmer water.

Breathing Temperatures

Just how cold the air from your first stage is depends on a lot of factors: higher tank pressures, deeper depths and faster breathing rates all work to make the air colder. Below are examples of measured air temperatures in the first and second stage at varied water temperatures, depths and tank pressures.

1. The air temperature that comes out of the tank at the first stage will vary depending on factors like Tank Pressure, Depth and Water Temperature.
2. The chart below presents measured temperatures of the gas entering the second stage subject to varying environmental conditions without and with the benefit of the ScubaHeat.

BREATHING GAS TEMPERATURE VARIABLES		
TANK PRESSURE	DEPTH	WATER TEMPERATURE
3000 PSI/200 BAR	165'/50M	49°F/9°C
2500 PSI/172 BAR	132'/40M	40°F/4°C
3000 PSI/200 BAR	99'/33M	34°F/1°C
3000 PSI/200 BAR	132'/40M	34°F/1°C

BREATHING GAS TEMP. WITHOUT SCUBA HEAT		BREATHING GAS TEMP. WITH SCUBA HEAT	
[Tank, Depth, Water Temp]		INCREASED TO:	DIFFERENCE OF:
16°F/-9°C	26°F/-3°C	49°F/9°C	+12°F/1°C
-9°F/-23°C	8°F/-13°C	40°F/4°C	+32°F/17°C
-15°F/-26°C	0°F/-17°C	34°F/1°C	+34°F/18°C
-20°F/-29°C	-6°F/-21°C	34°F/1°C	+40°F/22°C

Note the data in the chart indicates, the breathing air temperatures at the second stage without the ScubaHeat are all below freezing (32°F/0°C), whereas with the ScubaHeat they are above the temperature needed to form ice.

Is it really that simple? Yes and no.

The NO part: The conditions that can cause a regulator to form ice and freeze up are extremely variable. The colder the water, the higher your tank pressure, the deeper you are, and the faster you breathe all work against you to chill the air and increase the risk of freezing. Deep, high exertion dives could freeze a regulator in relatively warm (50°F/10°C) water; whereas a relaxed shallow water dive might cause no problems.

It is important to understand that the ScubaHeat cannot raise the temperature of the air passing through it to a temperature greater than the surrounding water. If the surrounding water is at or very near the temperature needed to freeze freshwater, 32°(0°C), then it is possible that the air temperature at the second stage will also be low enough to begin the formation of ice. Whether or not ice will form depends on the rate of heat transfer and exposure time. You need to be aware that under these conditions you are closely approaching the limit of the effectiveness of the ScubaHeat.

The YES part: In spite of the limitations the ScubaHeat has as the surrounding water temperature approaches 32°F (0°C), there is significant effectiveness at water temperatures above freezing that still fall within the extreme to very cold range.

Most scuba regulators experience difficulty maintaining stability due to second stage ice formation when performing at moderate to heavy breathing rates at depth in water at and below 35°F (2°C) for even brief periods.

The ScubaHeat when coupled with an environmentally protected first stage has demonstrated it can aid the regulator to deliver satisfactory performance under these same conditions, and colder, for extended periods longer than the typical recreational dive.

For instance, the ScubaHeat has been tested in an independent laboratory in 35°F (4°C) water and demonstrated stable regulator performance at 200 feet of water (61 meters), a steady supply pressure of 3000 PSI (200 Bar) and a moderately heavy breathing rate of 62.5 liters/ minute for a duration of 30 minutes.¹

¹ Laboratory performance test data courtesy of Mike Ward, Dive Lab, Panama City, FL.

Not just regulator freeze protection but personal thermal protection too.



ScubaHeat helps reduce cold stress on the body and improve thermal comfort.

Most people breathe about 1000 times an hour exchanging a lung volume of about a liter per breath. After cold air enters the lungs it is warmed to a temperature nearly equal to body temperature, humidified and exhaled. This causes a tremendous respiratory heat loss and further advances chilling of the body.

Studies among mountain climbers have long demonstrated the benefits of wearing bavlavas or heat exchange facemasks to treat this condition. Using the Scuba Heat will help reduce respiratory heat loss and improve thermal comfort similarly.

Feel warmer by maintaining body heat: Breathing cold air causes a tremendous amount of heat loss from the body. You can reduce this loss with the Scuba Heat. Loss of body heat and a mildly lowered core temperature can cause shivering, increased heart rate, urge to urinate (bad for a dry suit) and decreases coordination and reflexes. Plus you feel uncomfortably cold.

Warmer extremities: Breathing warm air can help to keep your hands and feet warm. As your core body temperature cools, vasoconstriction takes place restricting the blood flow to the extremities to minimize heat loss to the surroundings. Breathing warmed air has been shown to increase mean skin temperatures and body temperatures.⁴

Maintain lung capacity: Breathing cold air will reduce your lung vital capacity reducing your breathing efficiency.

Protecting the Lungs: The negative effects of breathing cold air are well known. Breathing cold air can act as an asthma trigger. Airways can produce secretions to protect the lungs from harmful effects of cold air breathing and lead to coughing.

Keep the warm air in your dry suit: Adding air to your drysuit that is 20-30 degrees warmer than without ScubaHeat will over time keep you warmer.

▲ FOOTNOTES ▲

1. Countries within the European Union require scuba regulators to conform with the CE standard EN250 to qualify for distribution in Europe. There is an additional test requirement for qualification for use in cold water, below 50°F (10°C). Regulators that do not meet these requirements are marked ">10°C"
2. Testing performed with Atomic Aquatics B2 First and Second stages in 2017 at Dive Lab, Panama City FL.
3. RMV - respiratory minute volume is the product of breathing rate and the lung tidal volume. 62.5 liters/min. is a high rate reflecting heavy exertion typically used for regulator performance testing.
4. T.T Romet, J. Frim, C. Allen, R.J.Shepard and R.C. Goode. The effects of breathing warm air during cold exposure Arctic Medical Research, Vol 47 Suppl.1, pp. 272-276, 1998

MATERIALS

The ScubaHeat is made in the USA of the highest quality materials. The heat exchanging coil is made from a special corrosion resistant and thermally conductive copper/nickel alloy. The coil is permanently brazed to a chrome plated brass manifold with multiple warming ports for primary regulator and accessories.

⚠ WARNING ⚠

IMPORTANT SAFETY INFORMATION - PLEASE READ CAREFULLY

This product is intended to be used only by those competent, trained and certified by a nationally recognized SCUBA training agency. This manual is not a substitute for such training. Diving without such training is extremely hazardous and could result in serious personal injury or death.

SET UP



1. The first step is to install the short 11" hose included with ScubaHeat. Screw the large end fitting of the hose the into the 9/16-18 threaded fitting on top of the ScubaHeat manifold block. This is the cold side of the manifold, indicated by the blue temperature icon on the decal.

⚠ WARNING ⚠

Do not assemble any high pressure hoses to any ports of the ScubaHeat. The hoses or coil could rupture and could cause serious personal injury.



2. Next, select one of the LP ports on the warm side of the manifold indicated by the red temperature icon and install the 3/8-24 male end of your second stage hose. The top port is recommended so the regulator hose can pass over your right shoulder. Snug all connections with a wrench and pressurize to check for leaks. Do not use the end port on the cold side of the manifold.

The manifold has a total of 3 warm side ports. You may use any that give the best hose orientation. Any remaining warm side ports may be used for adding safe seconds or drysuits. The air entering the drysuit will be several degrees warmer than it would be coming directly from the first stage.



3. The third step is to screw the small fitting on the short hose of the ScubaHeat into the LP port of the first stage previously used for the second stage connection. Snug tighten with a wrench.
4. With the BCD in place on your tank, Attach the first stage to the tank

valve. Loosen the tank band and slide the open blade of the bracket onto the band, then tighten the band securely to mount the coil to the tank. Place the coil in a position where water is free to pass over it. Do not cover the coil or it will reduce the effectiveness of the heat exchanger.



There are many varieties and configurations of tank bands. Since the coil should mount on the right side of the tank, you may need to move or even reverse the position of your tank buckle. On the Atomic BCD (BC1), the band can be pulled out of the backpack to rotate the buckle around to make room for the coil.

Once mounted to the tank, you may want to secure the second stage hose to the coil inlet hose with a cable tie, velcro strap or plastic hose connector.

Once everything is assembled into place, pressurize the system and check of leaks. Test breathe from the second stage to make sure everything is working properly before exposure to a cold atmosphere or entering the water.

⚠ CAUTION ⚠**DO'S AND DO NOT'S**

Do set up your equipment carefully before each dive and check your entire system for signs of damage, loose hose fittings, and air leaks.

Do Make sure the yoke knob or DIN connection is hand tight before turning on your air supply.

Do not use your regulator if you notice any problems or malfunctions. Return it to the factory or authorized dealer to have it checked or repaired.

Do not pick up your tank by the hoses. You may damage them or work loose a connection that could lead to loss of air.

OPERATION

For optimum results, the coils of the ScubaHeat must be unobstructed so that water can move freely through and around them. **Do not shroud or otherwise cover the coils with anything that prevents the movement of water over the coil.** Remaining stationary for long periods of time may also reduce its effectiveness. There needs to be some water movement around the coils or heat exchange may not take place and some icing on the coil may occur.

It only takes a minimum amount of water movement around the coils for the ScubaHeat to operate, however if ice does build up on the external surfaces of the coils it will compromise the ability to warm the incoming air from the first stage.

If ice continues to form on the outside of the coil, you will have to discontinue the dive until the coils warm and ice is no longer present.

Note that the ScubaHeat must be immersed in water for the desired heat transfer to occur. Operation on land or even on the water surface with the coils exposed to air will significantly diminish the exchange of heat and the effectiveness of the device.

Precautionary procedures that are recommended for handling of your regulator in cold air before you enter the water also apply when the ScubaHeat is connected to your system.

POST DIVE CARE

A simple fresh water rinse after every dive to clean exterior of ScubaHeat is all that is required. You should be able to perform the post dive care recommended by the manufacturer of your regulator without the need to disconnect the ScubaHeat from the system. **Avoid soaking the regulator unpressurized, as water may enter the second stage and first stage mechanism.** If the second stage is purged when it is rinsed or soaked, it is a good idea to re-connect the regulator to a tank and blow out any water that may have entered the first or second stage.

REQUIRED SERVICE

There is little required service for the ScubaHeat other than rinsing with fresh water after use. We recommend having all o-rings and rubber hoses replaced every 3 years.

LIMITED LIFETIME WARRANTY (USA)

Atomic Aquatics warrants the ScubaHeat against defects in materials and workmanship for the lifetime of the original owner with the exception of hoses and o-rings, which are warranted for 2 years. Atomic Aquatics will at its option repair or replace any components it finds defective. This warranty only covers products purchased from authorized Atomic Aquatics dealers. To activate this warranty you must complete and return the warranty registration card within 30 days of purchase. Warranty registration is also available at www.atomicaquatics.com. Chromed or plated brass components are subject to corrosion and require as a minimum reasonable maintenance fresh water rinsing after use in salt water and proper storage as described in this manual. This warranty is not contingent upon proof of service and will maintain in effect for the lifetime of the original owner. It is recommended however that maintenance include an annual safety inspection to be performed by an authorized Atomic Aquatics dealer or by the factory. Factory or authorized dealer servicing is required every 3 years at which time we recommend replacement of all o-rings and rubber hoses. To obtain warranty service, you must deliver this product to Atomic Aquatics or one of its authorized repair facilities. If you send it to the factory, you must pay the shipping charges to the factory. If the product is returned to the factory and it is determined that the problem is due to material or manufacturing defect, there will be no charge for parts, labor or return shipping within the continental USA. This warranty does not cover damage or defects due to neglect, misuse, alteration, or attempted repairs by someone other than an authorized dealer. Atomic Aquatics shall not be liable for loss of use of this product or incidental or consequential costs or damages incurred with the use of this product. Some states do not allow this exclusion so the above may not apply to you. This warranty gives you specific legal rights and you may have other rights which vary from state to state.



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