



GC3 Flow-Stop In-line Gas Isolator Maintenance Manual

Version 1.3
March 2017
Written by Tino de Rijk

Table of Contents

1. Introduction	3
1.1 Functional description	3
1.2 Servicing	3
1.3 Warranty	3
1.4 Copyright and Applicable Law	3
2. GC3 Flow-Stop Exploded Diagram and Parts List	4
2.1 GC3 Flow-Stop main assembly	4
3. Service Kit Contents and Tools	5
3.1 Service Kit Contents	5
3.2 Tools Needed	6
4. Disassembly Instructions	7
4.1 Preparation: Remove the GC3 Flow-Stop from its MP hose	7
4.2 Unscrew the connector from the body	7
4.3 Remove the O-ring from the connector	8
4.4 Remove the collar from the body	8
4.5 Remove the insert from the body	9
4.6 Remove the two O-rings from the insert	10
4.7 Remove the three O-rings from the collar	10
4.8 End of the disassembly phase	11
5. Clean and Replace Service Parts	12
5.2 Ultrasonically clean deposits from all metal parts	13
5.3 Replace all O-rings with new ones from the Service Kit	13
5.4 How to lightly grease O-rings	13
6. Assembly Instructions	15
6.1 Refit the three O-rings onto the collar	15
6.2 Refit the two O-rings to the insert	16
6.3 Push the insert back into the body	17
6.4 Refit the collar to the body	18
6.5 Refit the O-ring to the connector	19
6.6 Screw the connector back into the body	19
6.7 End of the assembly phase	20
6.8 Fit the GC3 Flow-Stop back to its originating MP hose	21
7. Testing Instructions	22
7.1 Test for leaks and proper blocking operation	22

1. Introduction

1.1 Functional description

The APD GC3 Flow-Stop is an in-line gas isolator. It is operated by simply sliding the black knurled collar forwards in the direction of the gas flow to instantly cut off the gas supply. The Flow-Stop features large bore feed holes that are recessed to reduce O-ring wear. The high-flow design offers less restriction than others on the market and can be used with high volume open circuit 2nd stages.

1.2 Servicing

Before servicing this Flow-Stop gas isolator, you must receive instruction and certification in the maintenance of this gas isolator by AP Diving Ltd.

Without the correct training it is possible to configure the GC3 Flow-Stop gas isolator incorrectly in an unsafe manner. Factory or Dealer prescribed service for this gas isolator is recommended at least once annually.

The Inspiration, Evolution and Evolution+ closed circuit rebreathers' CE certification to EN14143 is unaffected by the fitting of this GC3 Flow-Stop in-line gas isolator.

This GC3 Flow-Stop meets the requirements of the Personal Protective Equipment Directive 89/686/EEC – CE certification when fitted to an AP Diving rebreather.



WARNING: when servicing the GC3 Flow-Stop gas isolator it is VERY important that all parts that may suffer wear and tear get replaced. It is also very important that the correct tools are used to avoid damaging any part of the gas isolator in the disassembly and assembly process. Please don't try to save money by re-using parts that really should be replaced during a proper servicing action.



The numbers between brackets after the part names in the disassembly and assembly chapters correspond to the sequence numbers in the diagrams in chapter 2.

1.3 Warranty

This GC3 Flow-Stop gas isolator is covered by APD's 2 year warranty against defects in materials or workmanship. This warranty is only extended to the original purchaser, and is not transferable. For more information, be sure to read the warranty section of the user manual, and the purchaser should save the sales receipt.

A copy of the receipt must be presented whenever obtaining warranty service.

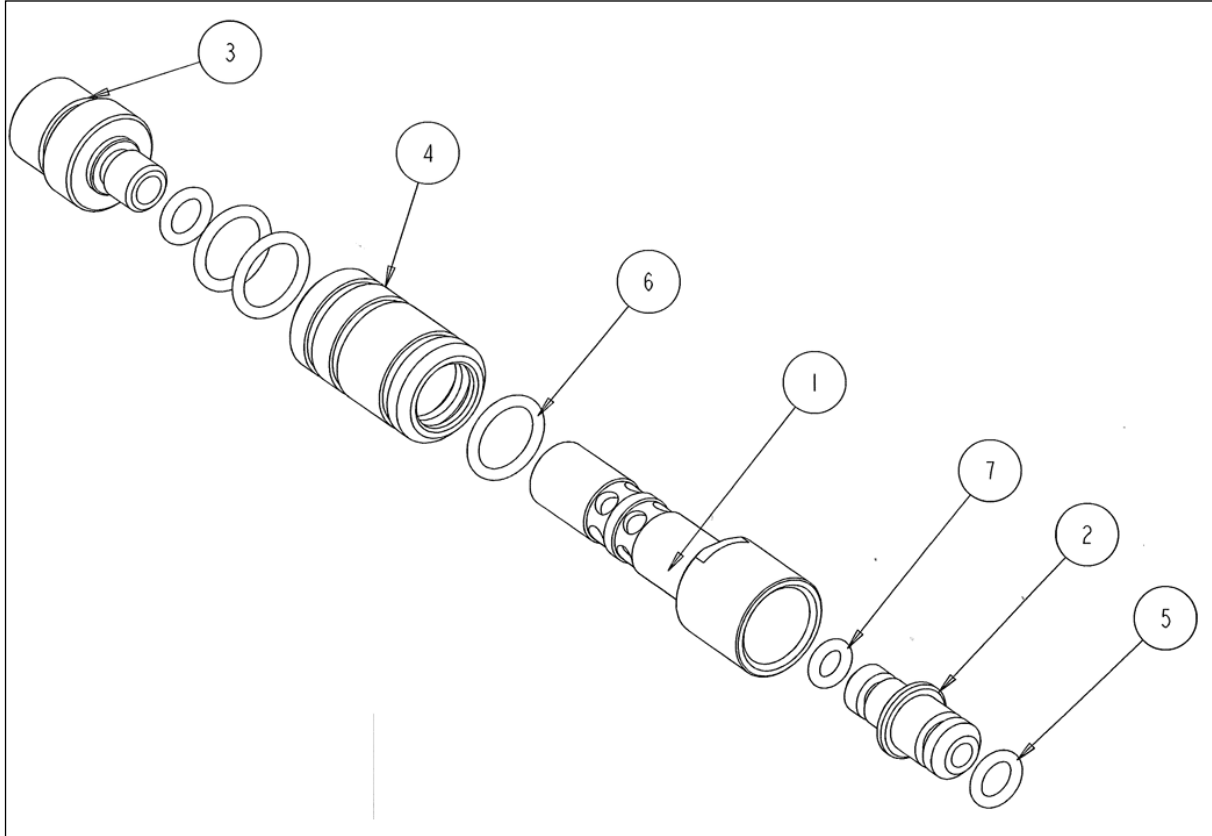
1.4 Copyright and Applicable Law

This Maintenance Manual is copyrighted, all rights reserved. It may not, in whole or in part, be copied, photocopied, reproduced, translated, or reduced to any electronic medium (including the Internet) or machine-readable form without prior consent in writing from AP Diving Ltd.

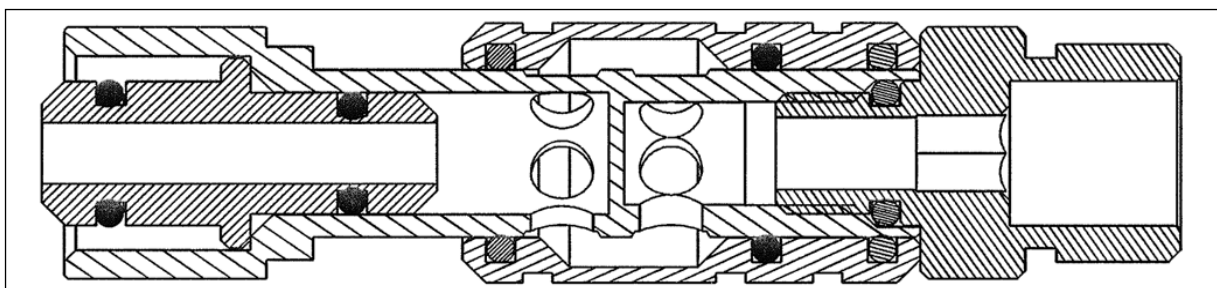
All products are sold on the strict understanding that only English Law applies in cases of warranty claims and product liability, regardless of where the equipment is purchased or used. Should a claim be made then the venue for this would be in Truro, England.

2. GC3 Flow-Stop Exploded Diagram and Parts List

2.1 GC3 Flow-Stop main assembly



NUMBER	DESCRIPTION	PART NUMBER	QUANTITY
1	Body	RB_70_21	1
2	Insert	RB_70_22	1
3	Connector	RB_70_23	1
4	Knurled collar	RB_70_24	1
5	BS010 O-rings on outside of insert and on connector	BS_010_N70	2
6	BS013 O-rings on inside of collar	BS_013_N70	3
7	BS008 O-ring on outside of insert	BS_008_N70	1



Cross section of GC3 Flow-Stop

3. Service Kit Contents and Tools

3.1 Service Kit Contents

⚠ WARNING: When replacing O-rings, next to the size, the hardness of the O-rings (declared in degrees Shore, and indicated by the suffixes N70 and N90) is ESSENTIAL for proper operation. The N70 hardness of the O-rings for the GC3 gas isolator is deliberately chosen by AP Diving.

If, against our recommendation, you choose to select your O-rings to come from another source than AP Diving Ltd., make sure you select the right type in size AND hardness AND material (composition).

When servicing the GC3 Flow-Stop, the following parts need to be replaced:

<u>NUMBER</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>QUANTITY</u>
5	BS010 O-rings on outside of insert and on connector	BS_010_N70	2
6	BS013 O-rings on inside of collar	BS_013_N70	3
7	BS008 O-ring on outside of insert	BS_008_N70	1



3.2 Tools Needed

There are no special tools needed for servicing the GC3 Flow-Stop gas isolator.

Normal tools needed are:

- 5 mm Allen key
- 14 mm wrench
- O-ring picking tools
- Oxygen-compatible grease
 - o see chapter 5 for remarks about when you need to keep this device in oxygen service
- (Access to) an ultrasonic bath for cleaning the metal parts.



WARNING: Do NOT use aggressive chemicals. They might damage the metal plating of the GC3 Flow-Stop. Use an ultrasonic cleaning bath with a suitable cleaning fluid. A very good cleaning fluid is Biox "O2" immersion fluid. See WWW.BIOXINT.COM for further information and distributors.

The use of rubber gloves while re-assembling the GC3 Flow-Stop is recommended to avoid rendering the GC3 Flow-Stop oxygen unclean due to human touch.

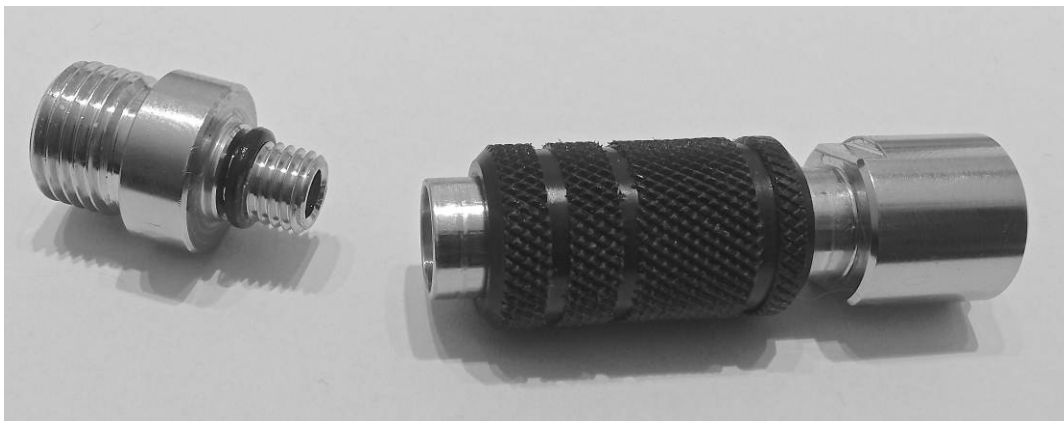
4. Disassembly Instructions

4.1 Preparation: Remove the GC3 Flow-Stop from its MP hose

- Remove the GC3 Flow-Stop from the MP hose it is attached to in-line.
 - o A typical use scenario is it being fitted to the inlet side of the ADV of an Inspiration rebreather.
 - In that case it is connected on one side to the MP hose coming from either the diluent 1st stage or the gas distribution bar (depending on the model of Inspiration rebreather), and on the other side it is screwed onto the rotating banjo of the ADV.
 - o In this particular and often occurring use, first disconnect (unscrew) the MP hose from the inlet side of the GC3 Flow-Stop.
 - o Next, slide the collar of the GC3 Flow-Stop upwards, making room to use a 14 mm wrench to unscrew the GC3 Flow-Stop from the ADV's rotating banjo.

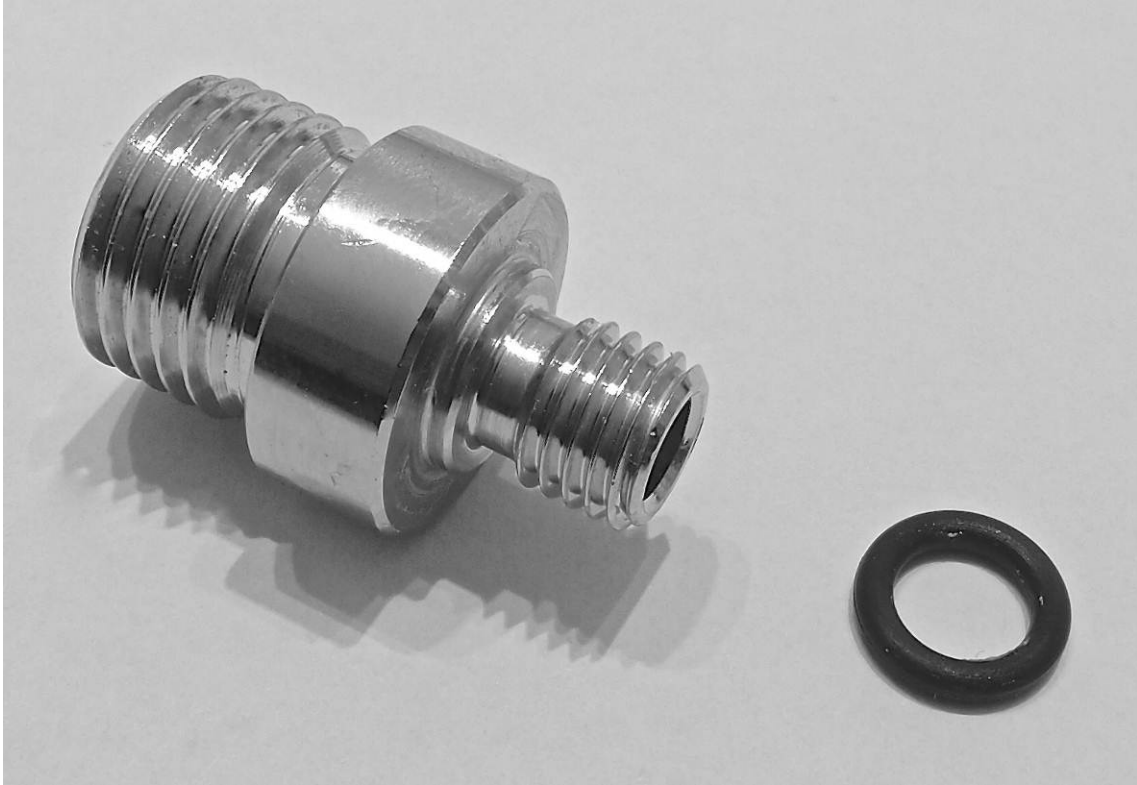
4.2 Unscrew the connector from the body

- Insert a 5 mm Allen key into the connector end of the GC3.
- Slide the collar towards the connector (inlet) side of the GC3.
- Use a 14 mm wrench to hold the body of the GC3, and unscrew the connector from the GC3 body, using the 5 mm Allen key.



4.3 Remove the O-ring from the connector

- Remove the BS-010 O-ring from the connector. Inspect the sealing area for any damage.




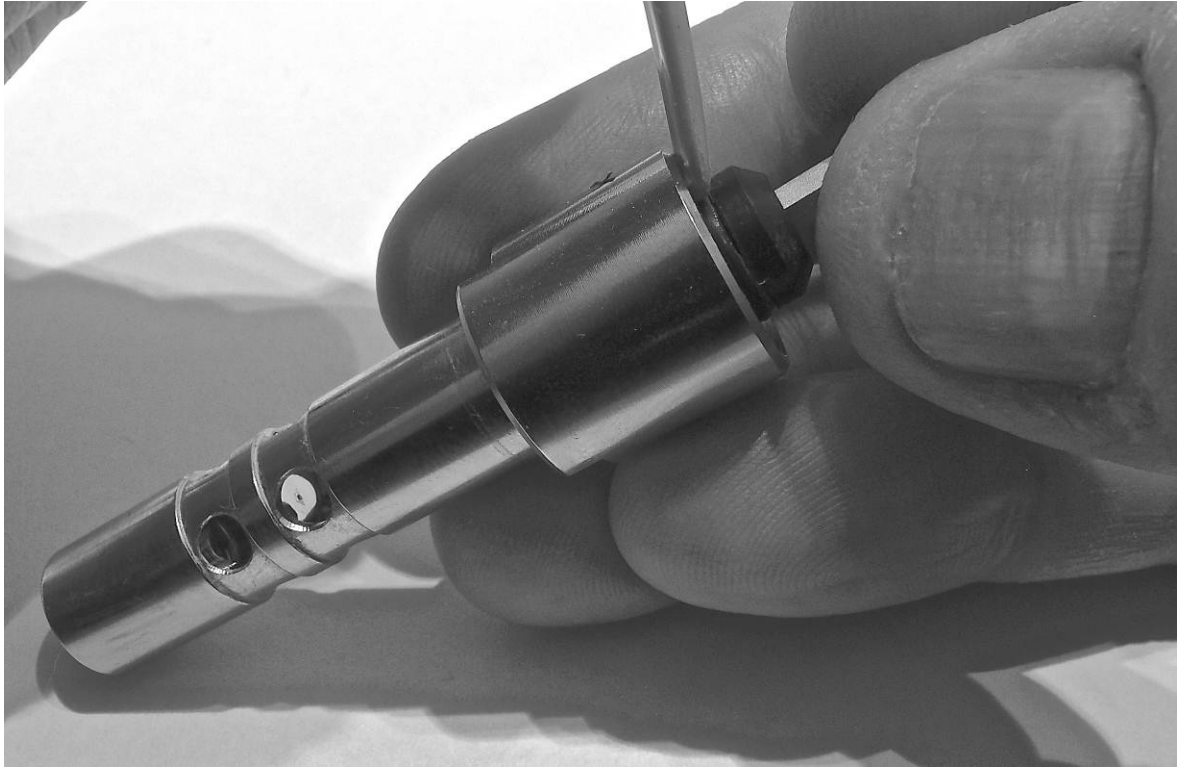
4.4 Remove the collar from the body

- Slide the collar off the GC3 body in a rotating movement.



4.5 Remove the insert from the body

-  **WARNING:** this is a delicate action, as it is very easy to damage the black plastic insert in the process.
- The insert is just pushed into the body of the GC3. It is not screwed in. It is held in place by the friction of the lower smaller O-ring.
- Insert a small Allen key (3 mm or so) into the hole of the black insert.
 - o This is just to stabilise it and to keep it vertical while prying it out.
- Next, using a small, non-sharp screw driver, gently pry the insert up and out of the GC3 body.
 - o Work your way around the insert in small steps.
 - o If at all possible, push on the underside of the visible O-ring, so you only damage the O-ring (which we will discard and replace anyway) and not the O-ring groove on the insert.
 - o Do NOT try to pry it out all the way in one go, as that requires too much force in one direction and may easily damage the O-ring groove on the insert.



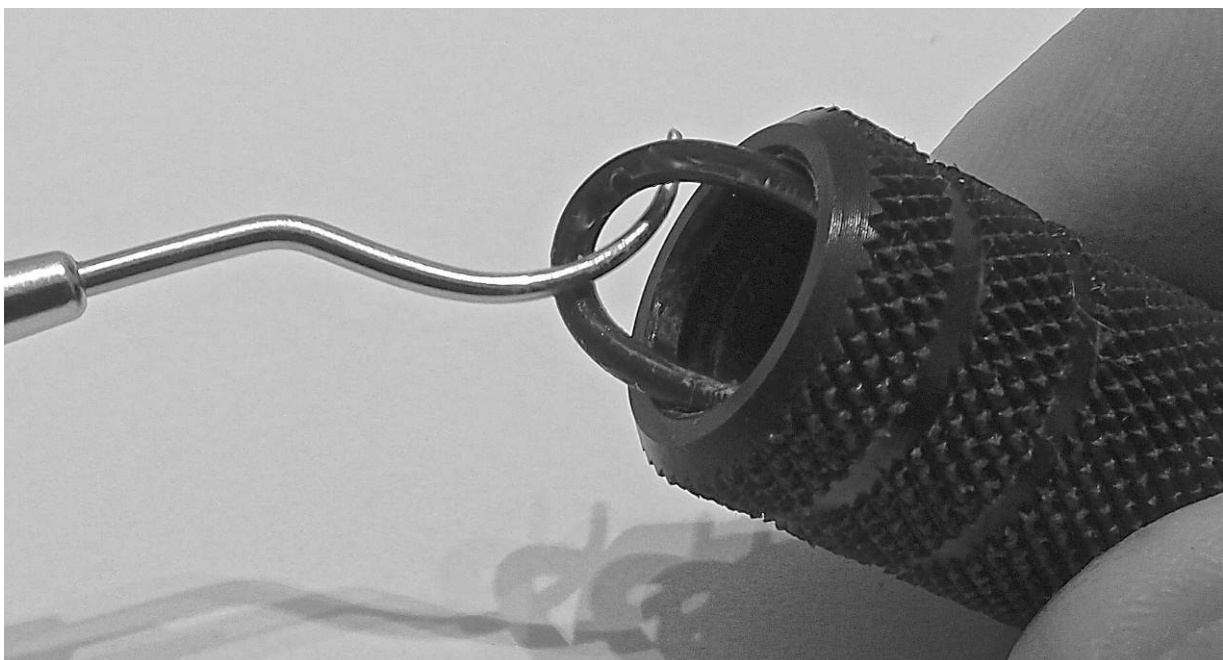
4.6 Remove the two O-rings from the insert

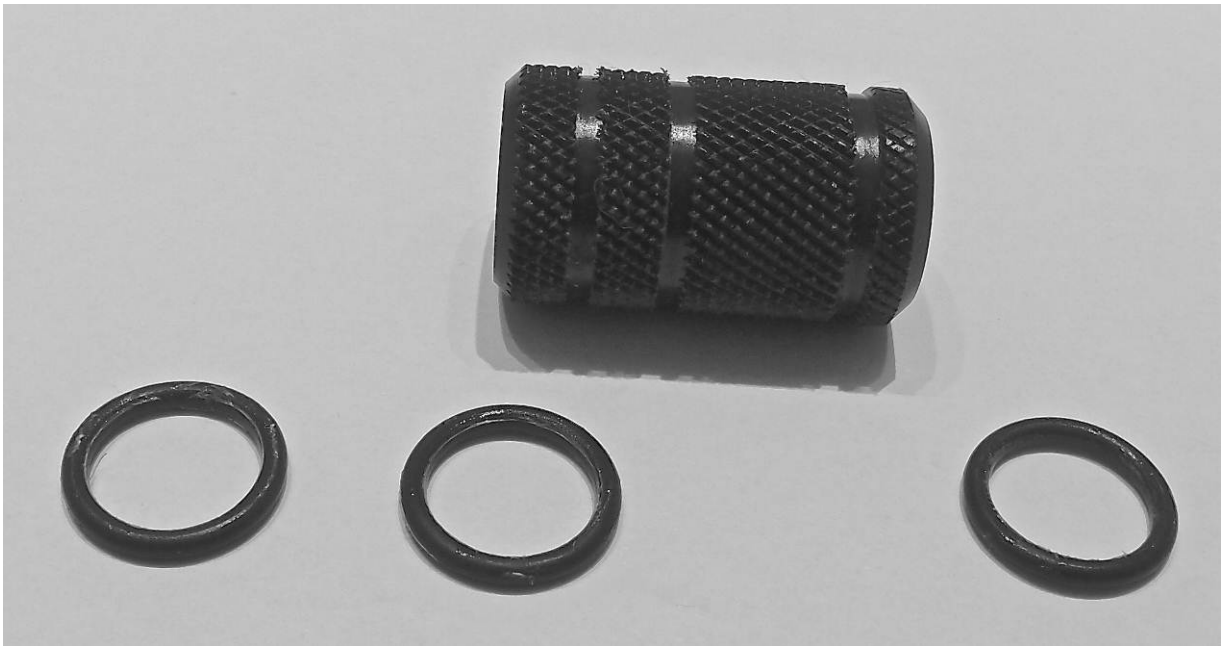
- Using a blunt O-ring picking tool, remove the two O-rings from the black plastic insert.
 - o Notice the different sizes of the O-rings: one is BS-008, the other BS-010.
- **!** **WARNING:** Take care not to damage both O-ring grooves. Inspect the grooves for wear, tear and damage after removal.



4.7 Remove the three O-rings from the collar

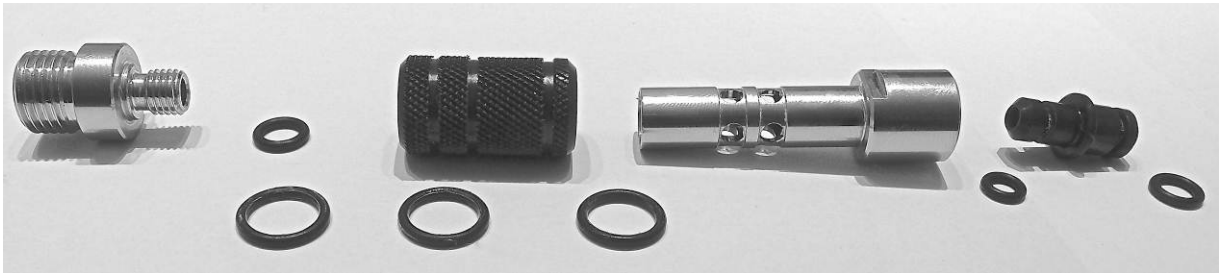
- **!** **WARNING:** this is a delicate action, as it is very easy to damage the collar in the process.
- Using a blunt O-ring picking tool, remove the three O-rings from the inside of the sliding collar. Notice the O-rings are all the same size: BS-013.
- **!** **WARNING:** Take care not to damage the three O-ring grooves. Do not use a sharp O-ring picker. After the O-ring removal inspect the grooves for wear, tear and damage after removal.





4.8 End of the disassembly phase

This concludes the end of the disassembly phase. The picture below shows all the parts together after disassembly.



5. Clean and Replace Service Parts

The servicing of the GC3 Flow-Stop inflator contains 4 “action groups”:

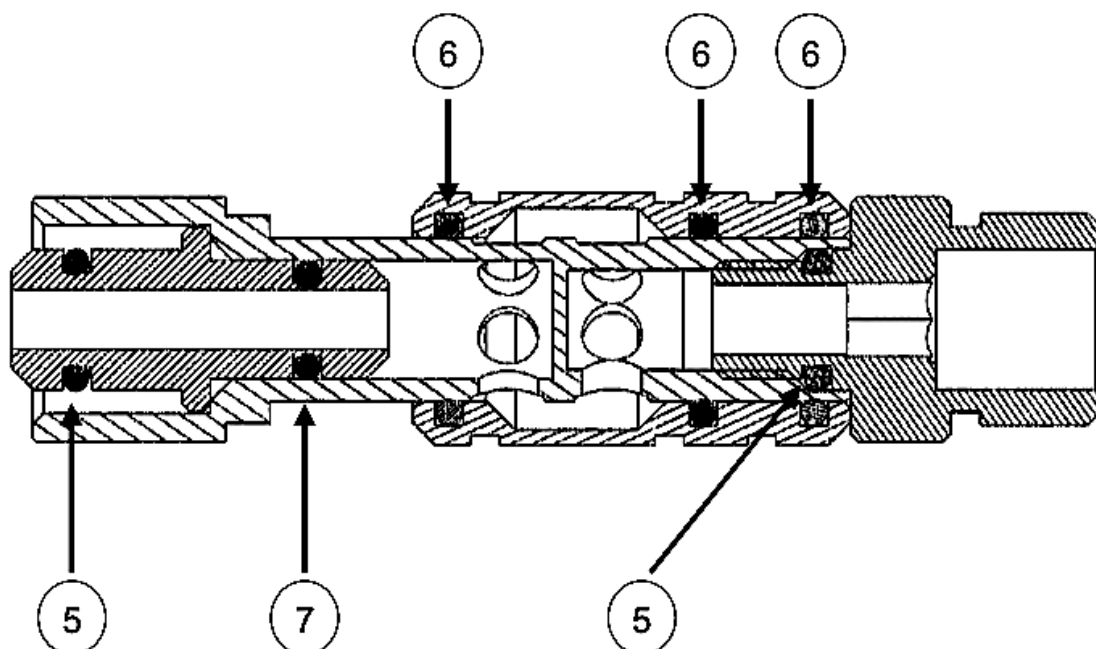
1. Removing and binning all parts that should be replaced. This includes all O-rings.
2. Depending on the gas content the GC3 Flow-Stop inflator is exposed to, keep it in oxygen service. The CGA (Compressed Gas Association), US Navy, UK’s HSE and the EIGA (European Industrial Gas Association) all recommend that breathing gasses with an oxygen content of 23.5% or higher should be treated as 100% oxygen. However, some technical training agencies still use 40% as the maximum percentage that is allowed for equipment that is not in oxygen service.
AP Diving advises to err on the side of safety, and to use the value of 23.5% as the cutoff percentage beyond which the equipment must be in oxygen service.
If in doubt: keep it in oxygen service, as that only takes a little bit more effort.
3. Ultrasonic-cleaning of all disassembled metal parts. This is mandatory if the GC3 Flow-Stop inflator is to be kept in oxygen service, but recommended in all other servicing situations.
4. Lightly grease new parts, fit them, and re-assemble the GC3 Flow-Stop inflator with the correct tools and the correct torques. Use oxygen-compatible grease, and avoid contaminating the metal parts after cleaning. Use the smallest amount of grease possible.

The use of rubber gloves while re-assembling the GC3 Flow-Stop is mandatory if the GC3 is to be kept in oxygen service. This is to avoid rendering the GC3 Flow-Stop unclean due to human touch (skin oils, sweat).

As described in chapter 3.1, the following parts need to be replaced when servicing the GC3:

NUMBER	DESCRIPTION	PART NUMBER	QUANTITY
5	BS010 O-rings on outside of insert and on connector	BS_010_N70	2
6	BS013 O-rings on inside of collar	BS_013_N70	3
7	BS008 O-ring on outside of insert	BS_008_N70	1

On the cross section below you can see where the new O-rings need to go respectively:



5.2 Ultrasonically clean deposits from all metal parts

Clean deposits from all metal parts, like chalk and salt.

! WARNING: Do NOT use aggressive chemicals. They might damage the metal plating. Use an ultrasonic cleaning bath with a suitable cleaning fluid instead. A good cleaning fluid is Biox "O2" immersion fluid. See WWW.BIOXINT.COM for further information and distributors.

5.3 Replace all O-rings with new ones from the Service Kit

! WARNING:

- Replace all O-rings: do NOT re-use old ones
- ONLY use original parts from APD, to make sure the O-rings:
 - o Are the exact size
 - o Are of the correct material (especially important in a high oxygen content and overpressure environment)
 - o Are of the correct stiffness (degrees Shore).
- Make sure you use only oxygen-compatible grease.
- Also make sure you only use oxygen-clean and oxygen-compatible replacement parts. All APD-supplied O-rings in the service kit are made from Nitrile and as such are oxygen compatible. However, they still need to stay or be made oxygen-clean.
- Last but not least: avoid touching oxygen-clean parts after cleaning with your bare hands. Human body sweat and grease are not oxygen-compatible. So use rubber gloves (e.g. surgical) when re-assembling the GC3 Flow-Stop.
- For photographic clarity no rubber gloves are worn on the photos in this manual.

5.4 How to lightly grease O-rings

When greasing O-rings, make sure NOT to use too much grease.

Especially O2 compatible grease has the potential to become stiffer over time, which may cause a hardened clot of grease to become a source for leaking.

The best way to grease O-rings is using a simple "grease bag".

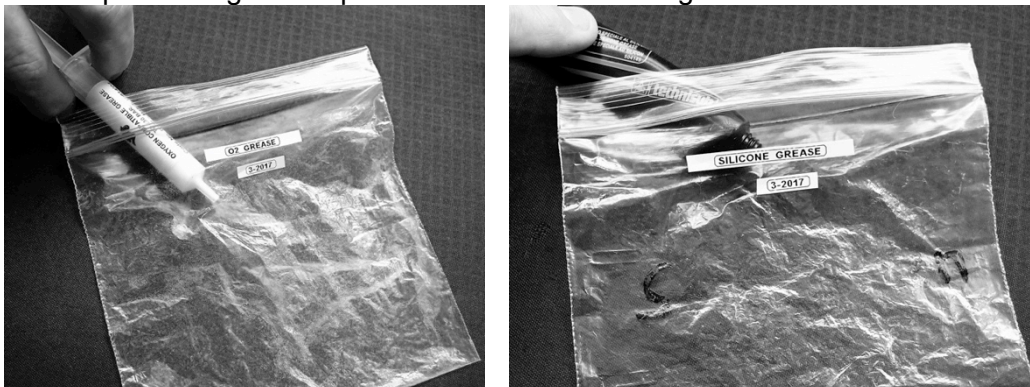
A grease bag is a clean and clear plastic bag, into which you put a small amount of grease. Optionally you can make two bags: one with O2 compatible grease, and one with normal silicone grease. Make sure you label them properly to avoid mixing them up! Also put a date on it, so you know how old your grease bag is. Don't use them longer than a year.

A nice advantage of using a grease bag is that you use only a tiny amount of grease for greasing many O-rings, so there is little waste.

We recommend that you use resealable bags, e.g. the ones with a plastic zipper, typically used for airtight food storage. This allows you to zip up the bag after use, keeping the contents clean for repeated use.

The simple steps are as follows:

- Take a plastic bag and deposit a SMALL amount of grease in it.



- Massage this grease all around the bag until it is evenly distributed over the inside surface area.
- Take the O-rings to be greased out of their storage container, either using gloves or using an O₂-cleaned instrument like a dentist hook.



- Drop them in the grease bag, and from the outside of the bag move them around with your fingers, making sure they get in full contact with the grease.



- Open the bag, and using a clean instrument like a dentist hook, take the now properly greased O-rings out.
- Inspect them to make absolutely sure that the grease is evenly and lightly distributed on the O-rings and that there are no areas of excess grease - no globs or strands.
- Fit them where they belong on your diving equipment, still making sure not to touch them with your bare hands.

6. Assembly Instructions

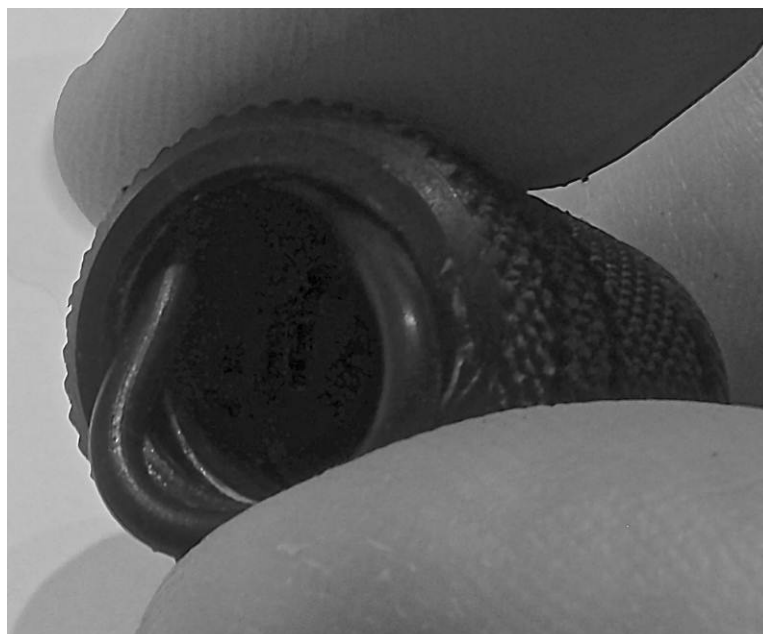
⚠ WARNING: When assembling the GC3 Flow-Stop, use rubber gloves to avoid polluting it while assembling, rendering it not oxygen-clean anymore.

6.1 Refit the three O-rings onto the collar

- If retaining the GC3 in oxygen service, make sure the O-rings are oxygen compatible (the original APD ones are), and that they are oxygen cleaned prior to use (e.g. in an ultrasonic bath).
- Lightly grease the new O-rings with oxygen compatible grease.
 - o **⚠ WARNING:** Make sure you do not use too much grease, as especially these three “dynamic” O-rings need to move easy and smoothly.
 - o Too much grease will just make them pick up salt or chalk or other dirt during the collar’s sliding movement. Making the O-rings just wet with grease is good enough.

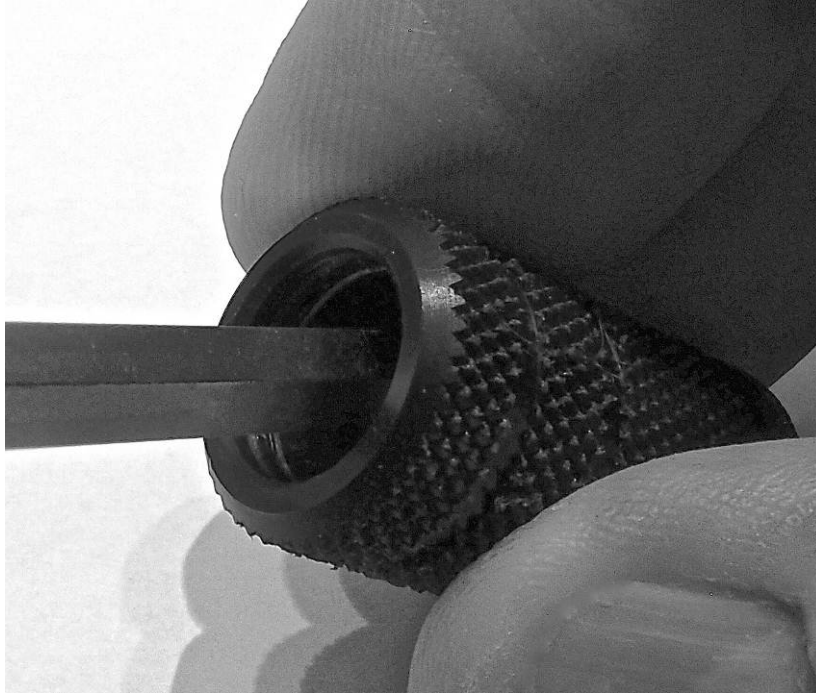


- First fit the two outer ones:
 - o Bend the O-ring and push one side of it into its groove.



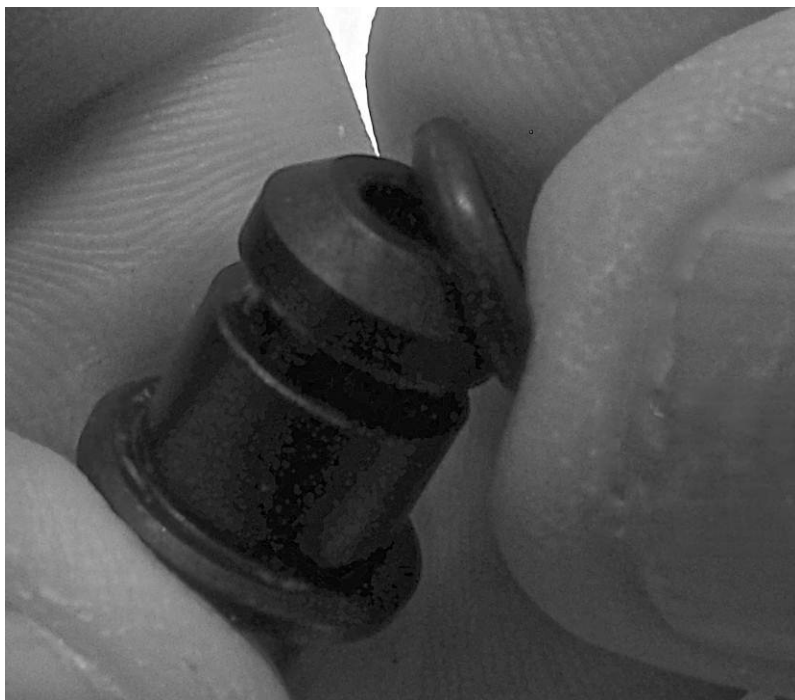
- Once fixed this way, push the rest of the O-ring into the groove, using a blunt round instrument. Do NOT use anything sharp.
- The third one, in the centre of the collar, is the most difficult one to put back.

⚠ WARNING: Make absolutely sure (by visual inspection after fitting, using a small torch) that it is indeed fitted properly into its groove, and has not dropped into the large gas bypass recess on the inside of the collar.



6.2 Refit the two O-rings to the insert

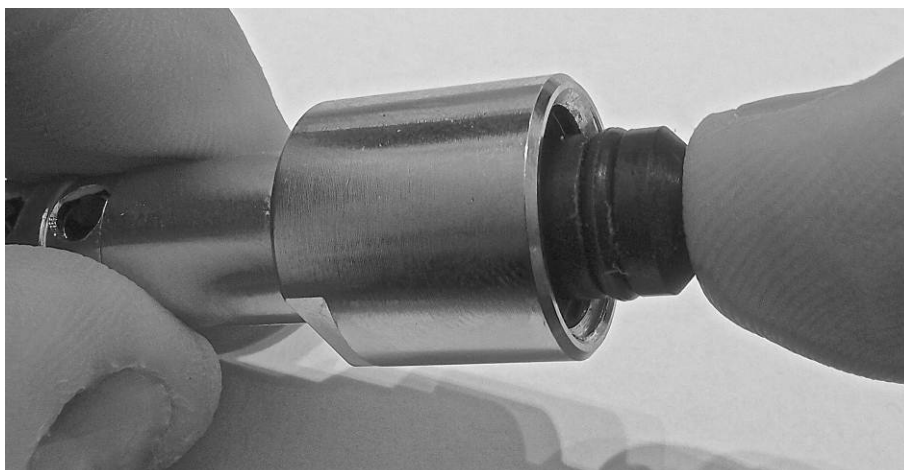
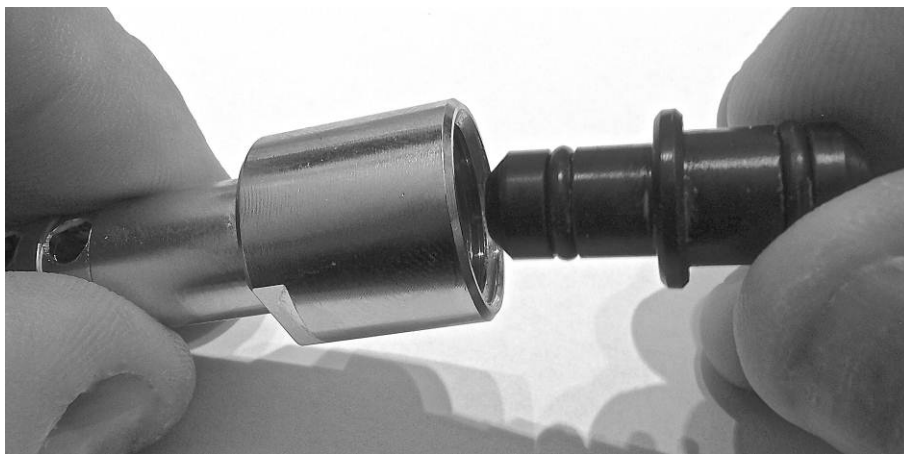
- Push the lightly greased O-rings into the grooves in the black plastic insert.
 - Do not use tools; slide them on by hand, as shown in the picture.





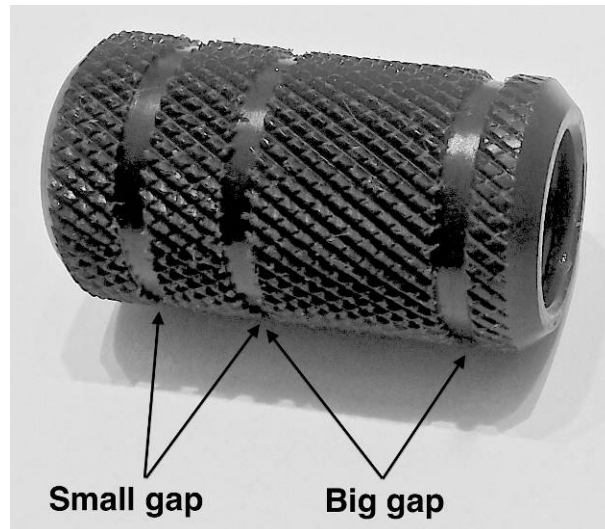
6.3 Push the insert back into the body

- Simply push the black plastic insert into the GC3 body.
 - o Notice the black insert has a large diameter and a small diameter.
 - o The small diameter goes inside the hole of the GC3 body. The larger diameter is on the outside.



6.4 Refit the collar to the body

- **⚠ WARNING:** notice the three grooves on the outside of the sliding collar. They are NOT evenly spaced. There is a small gap between two of the grooves, and a big gap between two other grooves.

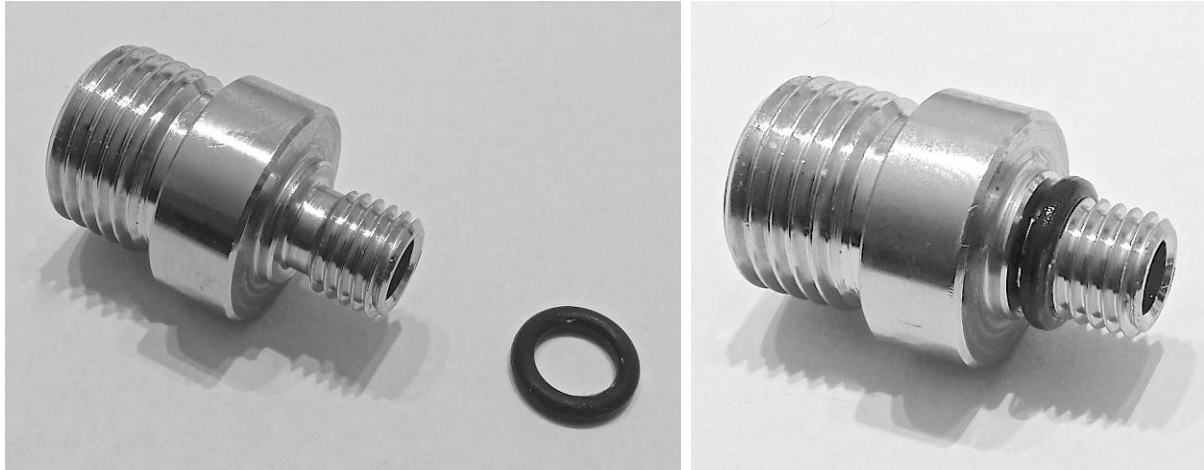


- Make sure that you slide the collar onto the body with the BIG gap pointing towards the thick end of the GC3 body, as shown in the pictures below.
 - o **⚠ WARNING:** if you fit the collar the wrong way (i.e. the small gap pointing to the thick end of the GC3 body), the GC3 Flow-Stop will NOT function, i.e. will NOT block the gas flow when it is moved into the closed position.



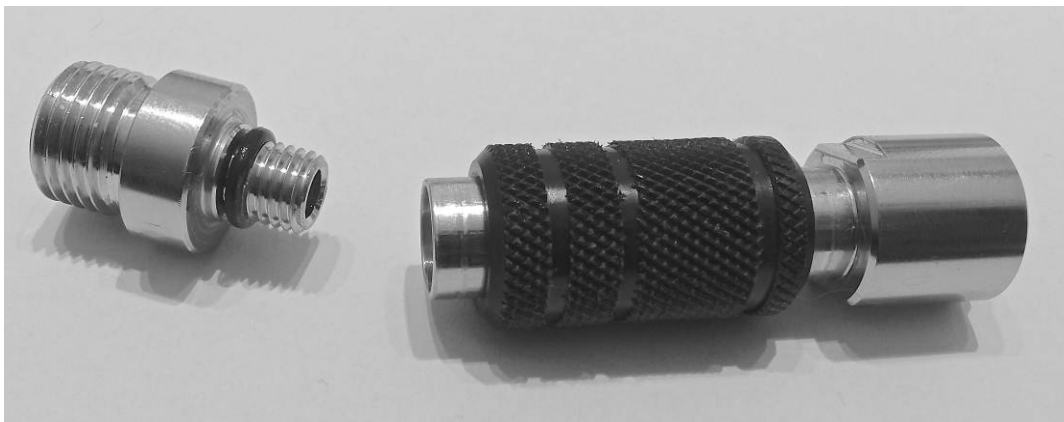
6.5 Refit the O-ring to the connector

- Fit a new, lightly greased O-ring onto the connector.



6.6 Screw the connector back into the body

- First screw the connector by hand hand-tight into the GC3 body.



- Next, insert a 5 mm Allen key into the connector, and use a 14 mm wrench on the GC3 body to hold it.
- Nip up the connector using the Allen key. Do NOT use force; that is not necessary, as the sealing is done by the O-ring, not by metal-to-metal force sealing.



6.7 End of the assembly phase

This concludes the end of the assembly phase. The picture below shows the GC3 Flow-Stop in-line gas isolator fully assembled, ready to be fitted back to the MP hose it came from.



6.8 Fit the GC3 Flow-Stop back to its originating MP hose

- Refit the GC3 Flow-Stop back to the MP hose it came from.
 - A typical use scenario is it being fitted to the inlet side of the ADV of an Inspiration rebreather.
 - In that case it is connected on one side to the MP hose coming from either the diluent 1st stage or the gas distribution bar (depending on the model of Inspiration rebreather), and on the other side it is screwed into the rotating banjo of the ADV.
 - In this particular case, first slide the collar of the GC3 Flow-Stop upwards, making room to use a 14 mm wrench to screw the GC3 Flow-Stop back onto the ADV's rotating banjo.
 - Next, connect (screw) the MP hose back onto the inlet side of the GC3 Flow-Stop.

7. Testing Instructions

7.1 Test for leaks and proper blocking operation

- Pressurize the MP hose to which the GC3 Flow-Stop is in-line connected (e.g. the one coming from the Inspiration diluent 1st stage or distribution bar, feeding into the ADV on the inhale counterlung).
- Once pressurized, close the HP cylinder valve again.
- Monitor the associated HP gauge (e.g. the one attached to the diluent 1st stage). The pressure should not drop.
- Move the collar a few times up and down the body. Make sure it travels all the way and smoothly. Monitor for any hissing sounds. Keep monitoring for pressure drop on the HP gauge.
- Optionally spray some soapy water (water with some detergent) on the GC3 and watch for bubbles. There shouldn't be any.
- Next, put the GC3 Flow-Stop in the closed position (collar pushed up), and use the attached equipment on the outlet side (e.g. press the membrane of the ADV). No gas should be coming out.
- Open and close the GC3 Flow-Stop a few times, verifying that the gas flow on the outlet side is indeed properly blocked in the closed position, and properly opened in the open position.
- If all tests are passed o.k. your maintenance has been successful.