



apeks[®]
TECHNICAL SUPPORT

DB4 1ST STAGE REGULATOR



MAINTENANCE MANUAL FOR AUTHORISED TECHNICIANS

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**DB4 1st Stage Regulator Maintenance Manual
(AP5839 Issue 1)**


INTRODUCTION


This manual provides factory prescribed procedures for the correct maintenance and repair of the Apeks DB4 1st Stage regulator. It is not intended to be used as an instructional manual for untrained personnel. The procedures outlined within this manual are to be performed only by personnel who have received factory authorised training through an Apeks Service & Repair Seminar. If you do not completely understand all of the procedures outlined in this manual, contact Apeks to speak directly with a Technical Advisor before proceeding any further.

WARNINGS, CAUTIONS & NOTES

Pay special attention to information provided in warnings, cautions, and notes that are accompanied by one of these symbols:

 **WARNINGS** indicate a procedure or situation that may result in serious injury or death if instructions are not followed correctly.

 **CAUTIONS** indicate any situation or technique that will result in potential damage to the product, or render the product unsafe if instructions are not followed correctly.

 **NOTES** are used to emphasise important points, tips, and reminders.

SCHEDULED SERVICE

It is recommended that the Apeks DB4 1st Stage regulator should be examined annually regardless of usage.

A full service should be performed every two years.

However, if you are at all unsure about the correct functioning of the Apeks DB4 1st Stage then it must be officially inspected immediately.

All service and inspection details need to be documented to keep the *Limited Lifetime Warranty* in effect.

A First Stage Official Inspection consists of:

1. A pressurised immersion test of the entire unit to check for air leakage.
2. Checking for stable medium pressure that is within the acceptable range.
3. Checking that all parts are tightly fastened together and that no parts are loose.
4. A visual inspection of the Environmental Diaphragm looking for tears or holes and checking the general condition.
5. A visual inspection of any filters for debris or discolouration.
6. Pulling back hose protectors and checking that the hoses are secure in the hose crimps.

If a regulator fails steps 1,2, or 3 the entire regulator should be serviced. If a regulator fails 4 or 5 it will be up to the technician's discretion whether or not a full service is required. Failure of step 6 requires replacement of the Hose.

HOSE INSPECTION & CLEANING PROCEDURE

Please refer to separate document labelled "Hose Inspection & Cleaning Procedure" for full details of the maintenance of hoses which can be found in the Technical section of the Apeks website.

AQUA LUNG[®]



**HOSE INSPECTION AND
CLEANING PROCEDURE**

GENERAL GUIDELINES

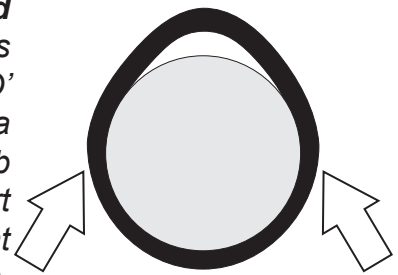
1. In order to correctly perform the procedures outlined in this manual, it is important to follow each step exactly in the order given. Read over the entire manual to become familiar with all procedures and to learn which specialty tools and replacement parts will be required before commencing disassembly. Keep the manual open beside you for reference while performing each procedure. Do not rely on memory.
2. All service and repair should be carried out in a work area specifically set up and equipped for the task. Adequate lighting, cleanliness, and easy access to all required tools are essential for an efficient repair facility.
3. During disassembly, reusable components should be segregated and not allowed to intermix with non-reusable parts or parts from other units. Delicate parts, including inlet fittings and valve seats which contain critical sealing surfaces, must be protected and isolated from other parts to prevent damage during the cleaning procedure.
4. Use only genuine Apeks parts provided in the 1st stage service kit (AP0241). DO NOT attempt to substitute an Apeks part with another manufacturer's, regardless of any similarity in shape or size.
5. Do not attempt to reuse mandatory replacement parts under any circumstances, regardless of the amount of use the product has received since it was manufactured or last serviced.
6. When reassembling, it is important to follow every torque specification prescribed in this manual, using a calibrated torque wrench. Most parts are made of either marine brass or plastic, and can be permanently damaged by undue stress.

GENERAL CONVENTIONS

Unless otherwise instructed, the following terminology and techniques are assumed:


1. When instructed to remove, unscrew, or loosen a threaded part, turn the part anti-clockwise.
2. When instructed to install, screw in, or tighten a threaded part, turn the part clockwise.
3. When instructed to remove an 'O' Ring, use the pinch method (see figure below) if possible, or use a brass, aluminium or plastic 'O' Ring removal tool. Avoid using hardened steel picks, as they may damage 'O' Ring sealing surfaces. All 'O' Rings that are removed are discarded and replaced with brand new 'O' Rings.


Pinch Method
Press upwards on sides of 'O' Ring to create a protrusion. Grab 'O' Ring or insert 'O' Ring tool at protrusion.



4. The following acronyms are used throughout the manual: MP is Medium Pressure; HP is High Pressure; PN is Part Number.
5. Numbers in parentheses reference the key numbers on the exploded parts schematics. For example, in the statement, "...remove 'O' Ring (19) from...", the number 19 is the key number to the Blanking Plug 'O' Ring.

DISASSEMBLY PROCEDURES

 **NOTE:** Before performing any disassembly, refer to the exploded parts drawing, which references all mandatory replacement parts. These parts should be replaced with new, and must not be reused under any circumstances - regardless of the age of the regulator or how much use it has received since it was last serviced.

 **CAUTION:** Use only a plastic, brass or aluminium 'O' Ring removal tool (PN AT79) when removing 'O' Rings to prevent damage to the sealing surface. Even a small scratch across an 'O' Ring sealing surface could result in leakage. Once an 'O' Ring sealing surface has been damaged, the part must be replaced with new. DO NOT use a dental pick, or any other steel instrument.


Removal of Hoses

1. Using a 9/16" spanner (or other, depending on hose fitted), remove all of the hoses from the first stage. Remove the O Ring (19) from the Hose Nut end of the Hose.



2. Pull back the two Hose Protectors and inspect the Hose Crimps. If either crimp is damaged or the hose is pulling out of the crimp then the hose must be replaced.



 **NOTE:** Please refer to separate document labelled "Hose Inspection & Cleaning Procedure" for full details of the maintenance of hoses which can be found in the Technical section of the Apeks website.

Removal of Blanking Plugs

3. Using a 5mm hex key (AT37) remove blanking plugs (18) and (20). Remove O Rings (19) and (21) from blanking plugs.




Removal of Dry Sealed Chamber


4. Using the First Stage Work Handle (PN AT48) clamp the regulator in a vice.



5. Using tool AT93 and a 3/8" drive T bar loosen the End Cap (1), then remove the tool and unscrew the End Cap fully by hand.



 **NOTE:** Press the tool AT93 onto the End Cap (1) firmly to ensure a perfect fit before fitting the T bar.

 **CAUTION:** Ensure the tool (AT93) is positioned flat on the End Cap (1) and even force is applied for removal. Failure to do so could result in the tool slipping and causing damage to the End Cap.

6. Remove Pressure Transmitter (2) and O Ring (5)



7. Unscrew the Diaphragm Clamp (6) using a 38mm spanner



8. Remove Spring (4) and Spring Carrier (8), then unscrew Spring Adjuster (3) from Diaphragm Clamp (6) by hand or using 6mm Hex key (AT38).



9. Remove O Ring (7) from the base of the Diaphragm Clamp (6).



10. Press down on the Diaphragm (9) towards the edge to enable it to lift. Using an O Ring pick (AT79) remove the diaphragm without causing damage to any sealing surfaces.

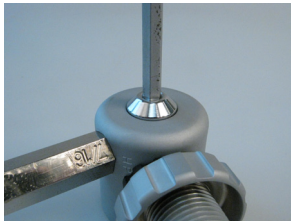


11. Remove the Valve Lifter (10) from the Body (11).



Removal of Balance Plug Assembly

12. Using a 6mm Hex key unscrew the Balance Plug (17) and remove.



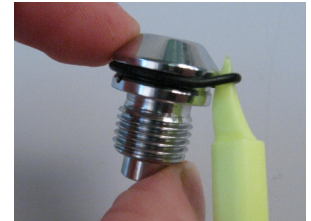
13. Separate the HP valve (12) and Spring (13) from the Balance Plug (17).




14. Using the hook part of the AT79 tool remove O Ring (14)



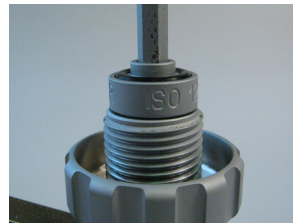
15. Remove O Rings (15) and (16) from the Balance Plug (17).



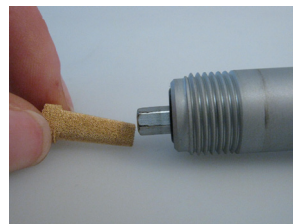
 **NOTE:** If the First Stage has a DIN Connection, follow step 16, if it has a Yoke Connection go to step 19.

Removal of Din Connection

16. Using a 6mm Hex key, unscrew the DIN Connector (30) and separate the parts.



17. Use a thin dowel or Hex key to remove Conical Filter (28) and O Ring (19).



18. Remove the O Ring (31) from the end of the Handwheel Connector (30).

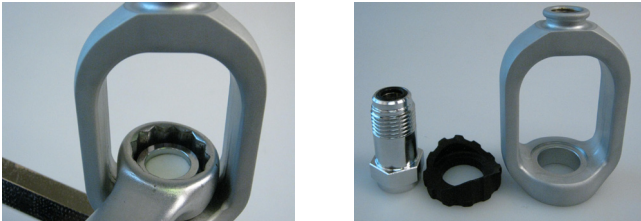


Removal of Yoke Connection

19. Unscrew the Yoke Knob (27) and remove the Dust Cap (26) from the Yoke Clamp (25).



20. Using a 3/4" A/F spanner, unscrew the Yoke Connector (23) and remove the Yoke Clamp (25) and Distance Piece (22).




21. Remove O Ring (19) from the Yoke Connector (23).



22. Insert a dowel or Hex key through the open end of the Yoke Connector (23) and push out the Disc Filter (24).



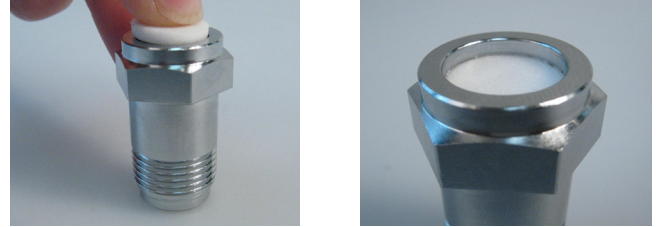
This Ends Disassembly


 **NOTE:** Before starting reassembly perform parts cleaning and lubrication according to the procedures outlined in 'Cleaning & Lubrication' on page 14.

REASSEMBLY PROCEDURES

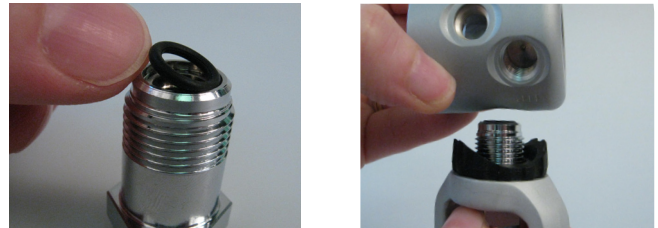
Assembly and fitting of Yoke Connection


1. Insert a new Disc Filter (24) with the smooth side out, into the Yoke Connector (23), ensure the filter is fully installed.



 **NOTE:** A flat bladed screwdriver may be used to assist installation.

2. Fit a new lubricated O Ring (19) into the end of the Yoke Clamp Connector (23). Insert the Connector through the Yoke Clamp (25) and Distance Piece (22). With the Valve Body (11) held so that the inlet connection port points down, screw the Yoke Clamp Connector into the Valve Body until finger tight.



 **CAUTION:** If the Yoke Clamp Assembly is not held vertically whilst it is screwed into the Valve Body, the O Ring in the end of the Yoke Clamp Connector may not remain in the correct position.

3. Secure the Valve Body (11) back into the vice using the First Stage Work Handle (AT48). Tighten the Yoke Clamp Connector (23) using a 3/4" A/F spanner to 20Nm (14.7 ft.lb).



4. Install the Protective Cap (26) with the logo facing outwards, onto the Yoke Clamp (25).



5. Screw the Yoke Knob (27) back into the Yoke Clamp (25), until the Protective Cap (26) is retained in place.




Assembling and fitting of DIN Connection

6. Install a new O Ring (31) into the face of the Handwheel Connector (30).

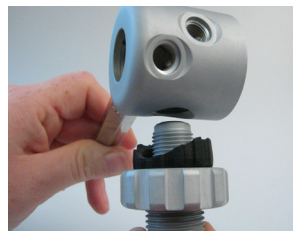



7. Install a new lubricated O Ring (19) into the opposite end of the Handwheel Connector (30). Install the Conical Filter (28) into the Connector, through the O Ring.



 **NOTE:** Ensure that the O Ring is retained in the Connector after the Conical Filter has been fitted.

8. Insert the threaded end of the Handwheel Connector (30) through the threaded end of the Handwheel (29) and spacer (22). With the Valve Body held so that the inlet connection port points down, screw the Handwheel Connector into the Valve Body (11) until finger tight.



 **CAUTION:** If the Handwheel Connector Assembly is not held vertically whilst it is screwed into the Valve Body, the O Ring in the end of the Handwheel Connector may not remain in the correct position.

9. Secure the Valve Body (11) back into the vice using the First Stage Work Handle (AT48). Tighten the Handwheel Connector (30) using a 6mm Hex key bit in a torque wrench to 20 Nm (14.7 ft.lb).



Fitting of the Dry Sealed Chamber

10. Drop the Valve Lifter (10) through the centre hole of the Valve Body (11). Press a new Diaphragm (9) into the Body. Run your finger around the edge of the diaphragm to make sure it is properly seated.



11. Screw the Spring Adjuster (3) into the Diaphragm Clamp (6) by hand or 6mm Hex key until flush.



12. Fit new Lubricated O Ring (7) onto the body side of the Diaphragm Clamp (6).



13. Fit new Lubricated O Ring (5) onto the Environmental End Cap side of the Diaphragm Clamp (6).



14. Place the spring carrier (8) and Spring (4) centrally onto the diaphragm (9). Thread the Diaphragm Clamp (6) onto the Body (11), making sure that the Spring remains on the Spring Carrier, until hand tight.



15. Using a 38mm Spanner (AT95) tighten the Diaphragm Clamp (6) to 30Nm (22.1 ft/lb).



Fitting of the Balance Plug

16. Fit new Lubricated O Ring (16) into the groove of the Balance Plug (17) and O Ring (15) to the base of the thread.



17. Install a new lubricated O Ring (14) into the end of the Balance Plug (17). Ensure that the O Ring is fully in place and seated correctly.



18. Press the Spring (13) onto the end of the Balance Plug (17).



19. Fit a new HP Valve (12) into the Balance Plug assembly, pressing the valve into place using the metal shoulder of the valve avoiding contact with the sealing face.



20. Insert the Balance Plug assembly into the body ensuring the HP valve (12) locates onto the lifter (10)



21. Using a 6mm hex fitting torque the Balance Plug to 8Nm (5.9ft.lb)



This Ends Re-assembly

ADJUSTING THE FIRST STAGE

⚠ WARNING: Compressed air can be highly explosive and is dangerous if misused. Ensure cylinder valve is opened slowly. Use Eye and Ear Personal Protective Equipment when performing any tests involving Compressed air.

1. Attach the first stage (with no Blanking Plugs fitted) to a fully charged 232 or 300 bar cylinder. Slowly open the cylinder valve, this will remove any particles or contaminants from the first stage.



2. Fit a new lubricated O Ring (21) to the HP 7/16" Blanking Plug and O Rings (19) to the MP 3/8" Blanking Plugs.



3. Using a 5mm hex fitting torque the Blanking Plugs (20) and (18) to 5Nm (3.69 ft.lb).



4. Attach a MP test gauge (0 - 20 bar) to a medium pressure hose and thread the hose into a MP port. If your test gauge does not have an over pressure relief valve, you must also attach a properly adjusted second stage to the first stage to act as the relief valve in case of a HP leak. Make sure Blanking Plugs are installed in any open ports.



⚠ CAUTION: If the pressure gauge rapidly exceeds 11 bar, then there is a HP leak. Quickly close the cylinder valve and purge the regulator. Refer to the troubleshooting table for the causes of the leak.

5. Slowly open the cylinder valve to pressurise the first stage and check for any audible leaks. If no leaks are detected adjust the MP by turning in the Spring Adjuster (3) with a 6mm Hex key.



NOTE: It is best practice to make adjustments with the first stage depressurised and setting the pressure with a supply of 207 Bar.

Turning in the Spring Adjuster (3) increases the MP; Turning out the Spring Adjuster decreases the MP. Turn the Spring Adjuster in 1/8th turn increments and purge the relief valve several times after each adjustment. When the MP reaches the nominal set point of 9.5 ± 0.5 bar (135 psi gauge reading - see table 5), purge the relief valve on and off 10-15 times. After cycling watch the gauge needle. The first stage MP should “lock-up” and be stable at the set point. Make any adjustments as necessary. Allow the first stage to stay pressurised for several minutes and check the MP again to make sure it remains “locked-up” between 9 and 10 bar (130.5 and 145 psi). If the MP creeps upward more than 0.25 bar (3.6psi), then there is a leak. Refer to the troubleshooting table on page 12 for possible causes.

6. Close the cylinder valve and depressurise the regulator by opening the gauge relief valve or by pressing the purge button of the second stage regulator. Close the relief valve and repressurise the system. The MP should still read between 9 and 10 bar. If the pressure reading is different than the original setting, repeat steps 4 and 5 until the MP is stable.

This Ends Adjustment

Final Assembly

1. With the regulator still pressurised, insert the Load Transmitter (2) into the Diaphragm Clamp (6).



2. Press the End Cap (1) into the AT93 tool by hand, ensuring that it sits evenly, then screw onto Diaphragm Clamp (6) hand tight.



3. Fit the torque wrench into the AT93 tool and tighten to a torque value of 12Nm (8.85 ft.lb). Re-check the medium pressure making sure that it is still between 9 and 10 bar.



CAUTION: Ensure the tool (AT93) is positioned flat on the End Cap (1) and even force is applied for fitting. Failure to do so could result in the tool slipping and causing damage to the End Cap.

4. Close the cylinder valve and depressurise the regulator. Remove the test gauge and reinstall the Blanking Plug.

This Ends Reassembly

Immersion Test

With the Blanking Plugs and at least one properly adjusted second stage installed, slowly open the cylinder valve and pressurise the first stage. Completely submerge the first stage in fresh water and check for leaks.

NOTE: Do not confuse bubbles from trapped air with a true air leak. If there is an air leak, bubbles will come out in a steady constant stream.

Assuming that there are no leaks, close the cylinder valve and depressurise the regulator. Remove the first stage from the valve and secure the Dust Cap (26) in place with the Yoke Clamp Knob (27). If the regulator has a DIN connection fit the Protective DIN Cap (32).




If a leak is detected, note the source of the leak and refer to the troubleshooting table on page 12 for possible causes and corrective actions.

This Ends Testing

Table 1 - Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
High Pressure Creep (also causes second stage leaks)	1. HP Valve (12) is worn or damaged.	1. Replace HP Valve.
	2. O Ring (14) inside Balance Plug (17) is damaged or worn.	2. Replace O Ring.
	3. O Ring (15) on Balance Plug (17) is damaged or worn.	3. Replace O Ring.
	4. Balance Plug (17) internal wall damaged.	4. Replace Balance Plug.
External air leakage	1. Blanking Plug O Rings (19) or (21) are worn or damaged.	1. Replace O Ring.
	2. Diaphragm (9) worn or damaged.	2. Replace diaphragm.
	3. Diaphragm seating surface damaged.	3. Replace Valve Body.
	4. Connector O Ring (19) worn or damaged.	4. Replace O Ring.
	5. Diaphragm Clamp (6) loose.	5. Tighten Diaphragm Clamp.
	6. O Ring (16) on Balance Plug (17) worn or damaged.	6. Replace O Ring.
Restricted air flow or high inhalation resistance through entire system	1. Cylinder valve not completely open.	1. Open valve, check fill pressure.
	2. Cylinder valve requires servicing	2. Switch to different cylinder.
	3. Conical Filter (28) or Disc Filter (24) is clogged.	3. Replace filter.
	4. Very Low Medium Pressure.	4. Adjust Medium Pressure to between 9 and 10 bar.
Environmental End Cap distended or burst	1. Diaphragm (9) worn or damaged.	1. Replace Diaphragm
	2. Diaphragm seating surface damaged.	2. Replace Valve Body.
	3. Diaphragm Clamp (6) loose.	3. Tighten Diaphragm Clamp.

Table 2 - Recommended Tool List

PART #	DESCRIPTION	APPLICATION	IMAGE
AP0430	I.P. test gauge	Intermediate pressure testing	
AT79	O Ring removal pick	O Ring removal	
AT48	First Stage Work Handle	Clamping Valve Body in Vice	
N/A	Flat bladed Screwdriver	AP1406 Filter Fitting	
N/A	Torque wrench, Nm or lb./ft	Installation of Balance Plug & DIN Connection	
N/A	6mm Hex key bit for torque wrench	Installation of Balance Plug & DIN Connection	
N/A	9/16" spanner	Hose Removal	
AT37	5mm Hex key	Blanking Plugs	
AT38	6mm Hex key	Removal of Balance Plug, DIN Connection & Spring Adjuster	
AT95	38mm Crow's Foot Wrench	Removal and Fitting of Diaphragm Clamp	
AT33	3/4" ring spanner	Removal and fitting of Yoke Clamp Connector	
N/A	232 or 300 bar Diving cylinder	Testing of regulator	
AT93	End Cap Removal Tool	Removal and Fitting of Environmental End Cap	
N/A	T Bar 3/8"	Removal of Environmental End Cap	



NOTE: 1. Images are not to scale.
 2. Actual tools may differ from images

Table 3 - Recommended Lubricants, Cleaning & Disinfectant Solutions

LUBRICANTS	APPLICATIONS	SOURCE
Christo-Lube MCG111	All o rings. Oxygen Compatible	Aqua Lung # 820466 or 480025 or AP1495
PerFluroLube 20/1	All o rings. Oxygen Compatible	Aqua Lung # AP1493

⚠ CAUTION: Silicone rubber requires no lubrication or preservative treatment. DO NOT apply grease or spray to silicone rubber parts. Doing so may cause chemical breakdown, can change their molecular construction and cause premature deterioration of the material

GENERAL CLEANING SOLUTIONS		
Liquid dishwashing detergent (diluted with hot water) *Soapy water is defined as 'household' grade liquid dishwashing detergent diluted in warm water.	Degreaser for brass and stainless-steel parts; general cleaning solution for plastic and rubber parts	'Household grade'

⚠ CAUTION: Do not place plastic and rubber parts in acid solutions. Doing so may alter the physical properties of the component and cause degradation and premature breakdown.

White distilled vinegar (acetic acid, 50% warm water)	Acid bath for reusable stainless steel and brass parts	'Household grade'
OAKite #31 (diluted with warm water to a maximum of 25%)	Acid bath for reusable stainless steel and brass parts	Oakite Products, Inc.
NETALU (diluted with warm water to a maximum of 25%)	Acid bath for reusable stainless steel, brass and aluminium parts	Aqua Lung ref# 455001


⚠ CAUTION: Do not use hydrochloric acid, (muriatic acid, spirit of salt), for the cleaning of any parts. Even if strongly diluted, hydrochloric acid can harm the coating of metal parts and leaves a corrosive deposit that is harmful and damages plastic parts and O-ring seals.

Table 3 - Recommended Lubricants, Cleaning & Disinfectant Solutions Continued

Oxygen Cleaning Solutions	Use as Trained	
Promoclean TP1113 or TP108 (diluted with warm water to a maximum of 5%)	Nitrox/Oxygen Cleaning	Inventec Performance Chemicals SA 20, Rue de Bourgogne BP 211 69802 Saint-Priest Cedex
BIOX O2 Liquid	Nitrox/Oxygen Cleaning	The Granary, Yeo Lane, North Tawton, Devon, UK. EX20 2DD www.bioxint.com
Disinfectant solutions		
Liquid dishwashing detergent (diluted with warm water) *Soapy water is defined as 'household' grade liquid dishwashing detergent diluted in warm water	General low risk disinfecting	'Household grade'
Chemgene HLD4L breathing apparatus surface disinfectant solution. Follow the manufacturers dilution recommendations	All round non-corrosive disinfecting for all plastic and metallic parts. Shared training and rental equipment	http://www.medi-mark.co.uk
STERANIOS 2% Ready to use. (Toxic, follow manufacturer's instructions for use)	All round disinfecting for all plastic and metallic parts. Shared training and rental equipment	Aqua Lung Ref: 382062

 **CAUTION:** Disinfection of products for multi-use applications such as Training and rental equipment must be carefully considered. Do not use bleach based disinfectants or disinfectants known to be corrosive, such as Milton, as these can prematurely age or corrode the equipment being used.

 **WARNING:** Never use solvents to clean breathing equipment or components

 **NOTE:** Always follow the guidelines of use, cleaning procedures and safety data sheets published by the cleaning and disinfectant solution manufactures. Methods, temperatures, dilution ratios and times can vary. These cleaning solutions and disinfectants have been developed and are intended for use with compressed oxygen diving and life support systems and are accompanied with detailed information.


Always follow your local regulations and cleaning solution guide lines regarding disposal.

Cleaning & Lubrication Procedure

 **WARNING:** Always wear the appropriate Personal Protective Equipment such as medical gloves and safety glasses.

General Cleaning of Brass and Stainless-Steel Parts

1. Pre-clean by soaking in warm soapy water*. If required soak in NETALU diluted to 25%, or other diluted general cleaning solutions as recommended and shown in the Recommended Cleaning Solutions table. Use a nylon bristle toothbrush as required.
2. Thoroughly clean the parts in a hot ultrasonic bath filled with a mixture of soapy water*. If some deposits remain then fill the bath with diluted white vinegar (acetic acid), max 50%, and repeat.

 **CAUTION:** Do not place plastic, rubber, silicone or anodised aluminium parts in contact with Vinegar.

3. Remove parts from the ultrasonic cleaner, rinse and soak parts for ten minutes with fresh water, agitate lightly. If tap water is extremely 'hard' then rinse in distilled water to prevent any mineral residue. Dry with filtered low pressure (1.75 bar/25psi) air or leave to dry naturally. Check that their condition is now suitable for re-use.

General Cleaning of Plastic, Composite, Rubber and Anodised Aluminium Parts

Anodised aluminium parts are to be soaked and cleaned with warm soapy water*. Use only a soft nylon toothbrush to scrub away any deposits. Rinse in fresh water and dry with filtered low pressure (1.75 bar/25psi) air or leave to dry naturally. Check that their condition is now suitable for re-use. If required prior to cleaning with warm soapy water and rinsing, pre-soak in NETALU diluted to 25%.

Parts made from plastic or soft materials such as rubber, for example, box bottoms, cases, covers etc., are to be soaked and cleaned with warm soapy water*. Use only a soft nylon toothbrush to scrub away any deposits. Rinse in fresh water and dry with filtered low pressure (1.75 bar/25psi) air or leave to dry naturally. Check that their condition is now suitable for re-use.

If required the use of an ultrasonic bath can be used, but only with warm soapy water.

 **CAUTION:** Do not place plastic and rubber parts in acid solutions. Doing so may alter the physical properties of the component and cause degradation and premature breakdown.


*Soapy water is defined as 'household' grade liquid dishwashing detergent diluted in warm water.

General Cleaning of Hoses.


Hoses shall be cleaned and maintained. Refer to Aqua Lung document 'Hose inspection and Cleaning Procedure'

 **CAUTION:** Do not place complete hose length in contact with acid solutions. Doing so may alter the physical properties of the component and cause degradation and premature breakdown.

Cleaning parts for Nitrox and Oxygen use

 **WARNING:** Please check the regulations regarding Oxygen/Nitrox in your particular country, as this may differ from Aqua Lungs standard policy. Always follow the training received for Oxygen Cleaning.

 **WARNING:** Always use genuine authorised service kit components and lubricants which are recommended and oxygen/nitrox compatible. New service kit components are also required to follow these cleaning guidelines.

 **WARNING:** During testing and use of the regulator following oxygen cleaning it is essential that only Oxygen Compatible Air in accordance with EN12021:2014 (or later) is used. Standard compressed Breathing Air in accordance with EN12021 or often referred to as Grade E in the United States, does not meet this criterion and could contaminate the regulator.

Although regulator second stage components are not exposed to high pressure oxygen/nitrox, Aqua Lung and Apeks recommends that the same cleaning procedure is followed for the complete regulator. This prevents the cross contamination and guarantees the cleanliness of the entire regulator.

Hoses shall be cleaned for Oxygen use in accordance with the Aqua Lung document 'Hose inspection and Cleaning Procedure'

1. Complete the General Cleaning sections on all parts as listed previously.
2. Ultrasonic cleaning at 50°C [122°F] in Promoclean TP1113 or TP108 diluted at 5%, or other Oxygen Cleaning Solutions shown in the recommended cleaning solutions list, for at least 6 minutes. **
3. Rinse in warm demineralised water. Soak for 10 minutes.
4. Dry in open air in a controlled clean and dust free atmosphere. Place the parts on a white cloth, allow to dry and check after drying that the cloth shows no grease deposits and that the condition of the parts are appropriate for reuse with Nitrox/Oxygen.

**Note: Always follow the guidelines of use, cleaning procedures and safety data sheets published by the cleaning and disinfectant solution manufacturers. Methods, temperatures, dilution ratios and times can vary. These cleaning solutions and disinfectants have been developed and are intended for use with compressed oxygen diving and life support systems and are accompanied with detailed information.

Wiping

To wipe parts, use a white filter paper, a pure cotton cloth or any other material that is lint free and does not produce fluff.

Inspection

Visually check under a white light (daylight or artificial light).

The parts are to be completely free of any traces of:

1. Organic materials (oil, grease, paint, rust....)
2. Cleaning agents
3. Dust
4. Humidity

Lubrication and Dressing for General and Oxygen use

When handling and lubricating O-rings, wear powderless latex gloves. Keeping internal parts free from skin oils and other contaminants is always important especially when the regulator is being prepared for Nitrox and Oxygen use. All Seals shall be lubricated with an oxygen compatible grease as recommended and shown in the lubricants table, such as Christo-Lube MCG111. Dress the O-rings with a very light film of grease and remove any excess by running the O-ring between thumb and forefinger. Do not apply excessive amounts of grease, as this will attract particulate matter that may cause damage to the O-ring.

Disinfecting parts and products. (Multi Use Rental and Training Equipment)


 **CAUTION:** Disinfection of products for multi-use applications such as Training and rental equipment must be carefully considered. Do not use bleach based disinfectants or disinfectants known to be corrosive, such as Milton, as these can prematurely age or corrode the equipment being used. Only use the recommended disinfectant solutions. Further information on recommended diluted solutions, when to use and risks are explained in document DOC-0053-O-02 Cleaning and Disinfectant Protocol for high level training use of Underwater Breathing Apparatus.

Table 4 - Torque Specifications

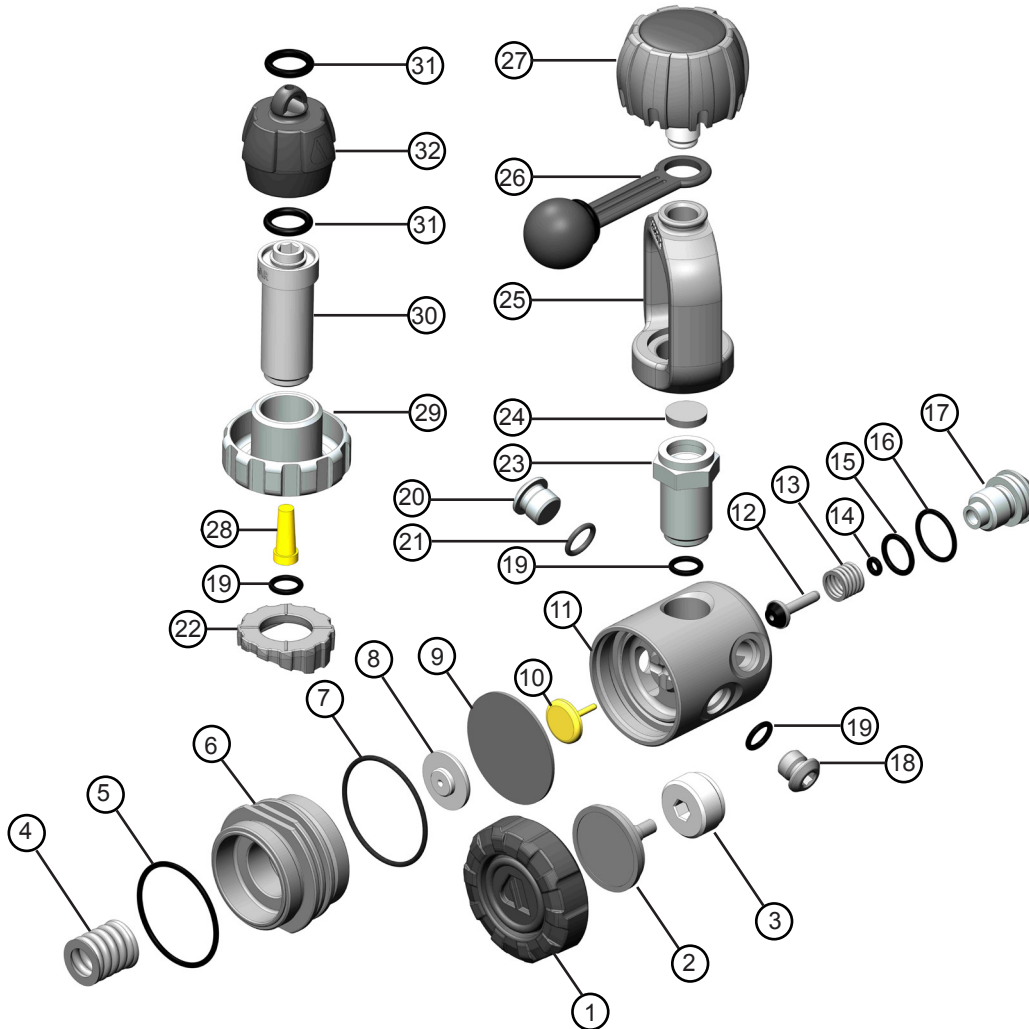
PART NUMBER	DESCRIPTION / KEY NUMBER	TORQUE
AP1471/S	Handwheel Connector (30)	20 Nm / 14.7 ft/lb
AP1407	Yoke Connector (23)	20 Nm / 14.7 ft/lb
AP5202	Balance Plug (17)	8 Nm / 5.9 ft/lb
AP2009S	Diaphragm Clamp (6)	30 Nm / 22.1 ft/lb
AP1408	Blanking Plug 3/8" (18)	5 Nm / 3.69 ft/lb
AP1413	Blanking Plug 7/16" (20)	5 Nm / 3.69 ft/lb
AP2010	Environmental End Cap (1)	12 Nm / 8.85 ft/lb

Table 5 - Test Bench Specifications

TEST	CONDITION	ACCEPTABLE RANGE
Leak Test	Inlet Pressure 150-232 bar / 2175-3364 psi	No Leaks Allowed
Medium Pressure	Inlet Pressure 207 bar / 3000 psi	9-10 Bar / 130-145 psi
Medium Pressure Creep	Inlet Pressure 207 bar / 3000 psi	0.25 Bar / 3.6 psi Max for 15 Seconds After Purging Regulator

Exploded Parts Diagram

AP0913 Din Version - AP0912 Yoke Version



All items in bold italics to be replaced when servicing. Service kit AP0241

1	AP2010	Environmental End Cap	17	AP5202	Balance Plug
2	AP1483	Pressure Transmitter	18	AP1408	3/8" UNF Blanking Plug
3	AP1474	Spring Adjuster	19	AP1409	O Ring
4	AP1475	Spring	20	AP1413	7/16" UNF Blanking Plug
5	AP2013	O Ring	21	AP1445	O Ring
6	AP2009S	Diaphragm Clamp, Finned Satin	22	AP1446	Distance Piece
7	AP7520	O Ring	23	AP1407	Yoke Connector
8	AP1476	Spring Carrier	24	AP1406	Filter
9	AP1478	Diaphragm	25	AP1403/S	Yoke Polished, Satin
10	AP1479	Valve Lifter	26	AP1404	Dust Cap
11	AP9007	4 Port Body Satin	27	AP0110	Yoke Knob
12	AP1419	HP Valve	28	AP1472	Conical Filter
13	AP1415	Spring	29	AP1470/S	Handwheel
14	AP1299	O Ring	30	AP1471/S	Handwheel Connector
15	AP1410	O Ring	31	AP1166	O Ring
16	AP1300	O Ring	32	AP6202	Din Dust Cap



**DB4 1st STAGE
REGULATOR
MAINTENANCE MANUAL
FOR
AUTHORISED TECHNICIANS**