



EXTRAIR CYLINDER VALVE



MAINTENANCE MANUAL FOR AUTHORISED TECHNICIANS

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AMENDMENTS RECORD:

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1013	0167	Update the Nitrox policy to the current revision	13/01/10	02	RH	ACD
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Extrair Cylinder Valve Maintenance Manual

(AP6520 Issue 1)

INTRODUCTION

This manual provides factory prescribed procedures for the correct maintenance and repair of the Extrair cylinder valve. 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 Extrair cylinder valve regulators should be examined annually regardless of usage. A full serviced should be performed every two years.

However, If at all unsure about the correct functioning of the Apeks first stage, then it must be officially inspected immediately.

All service and inspection details need to be documented in the Regulator Service Record in the back of the Owner's Manual to keep the Limited Lifetime Warranty in effect.

An 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.

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 (AP0???). 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

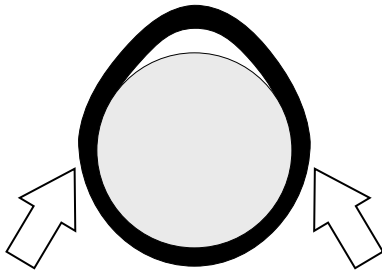
Unless otherwise instructed, the following terminology and techniques are assumed:

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 (4) from...", the number 4 is the key number to the Spring Carrier '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 hose

1. Using the appropriate spanners, remove all of the hoses from the first stage.



Removal of First Stage

2. Using a flat bladed screwdriver, open the Shroud (7). Insert the blade of the screwdriver between the joint of the Shroud and twist. Open the Shroud and remove from the assembly.



CAUTION: Do not over stretch the Shroud when removing from the Exair assembly.

3. Using a flat bladed screwdriver prise the Spring Clip (5) out of the Exair Body (4).



4. Separate the First Stage (9) and the Distance Piece (8) from the Exair.



NOTE: Refer to AP5317 DS, US, TEK3 & Exair First stage Maintenance Manual for details on how to service the Exair First Stage.

Removal of Pressure Indicator

5. Using a 22mm spanner unscrew the Pressure Indicator (16) from the Extrair Body (4).




6. Remove the two 'O' Rings (11) and (26) from the Pressure Indicator (16).



Removal of Charging Port

7. Using a 3/4" spanner, unscrew the Charging Port (13) from the Extrair Body (4).



 **NOTE:** Refer to DOC-0071-8-17 Fitting procedures for AP0668-1 for details on how to service the Charging Port.

8. Remove the 'O' Ring (6) from inside the Extrair Body (4). Using a 24mm Spanner, unscrew the Extrair Body (4) from the Cylinder (1).



9. Remove the 'O' Ring (2) from the thread of the Extrair Body (4).



Removal of Valve assembly

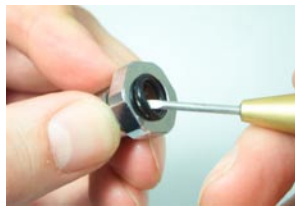
10. Using an 8mm Allen key, unscrew the Retaining Nut (17) from inside the Extrair Knob (19). Remove the Spring (18), Extrair Knob (19) and the Pin (25) from the Shaft (23). Using an 11/16" spanner, unscrew the Gland Nut (20) from the Extrair Body (4).



11. Using an 8mm Allen key, unscrew the Valve (24) from the Extrair Body (4).



12. Remove the Gland Nut (20) from the Shaft (23). Remove the two 'O' Rings (6) and (21) from the Gland Nut (20). Remove the PTFE Seal (22) from the inside of the Gland Nut (20).



This Ends Disassembly

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


REASSEMBLY PROCEDURES

Assembling and fitting of Gland Nut

1. Install a new 'O' ring (6) into the recess of the Gland Nut (20). Install new 'O' ring (21) over the threads of the Gland Nut (20).



2. Install a new PTFE Seal (22) onto the Shaft (23). Slide the Gland Nut (20) onto the Shaft (23). Ensure that the 'O' Ring (6) remains captive within the Gland Nut (20).

 **NOTE:** The PTFE Seal (22) and the shoulder of the Shaft (23) should be lubricated with Christo-Lube. The Gland Nut (20) should be turned on the Shaft (23) to ensure a smooth fit.



3. Using an 8mm Allen key, screw a new Valve (24) into the Extrair body (4). Screw in until the Valve touches the seat.



4. Tighten the Gland Nut into the Extrair Body (4) using an 11/16" spanner.



5. Insert the Pin (25) into the Shaft (23). Align the Extrair Knob (19) so that the slots are lined up with the Pin (25) and slide it onto the Shaft (23).



6. Push the Spring (18) onto the Retaining Nut (17). Drop the Spring and Retaining Nut into the Extrair Knob (19). Tighten the Retaining Nut (17) using an 8mm Allen key.



7. Install a new 'O' Ring (2) over the thread of the Extrair Body (4). Using a 24mm crows-foot and torque wrench, tighten the Extrair Body (4) into the Cylinder (1) to 65 Nm.



8. Screw the Charging Port (13) into the Extrair Body (4). Tighten using a 3/4" spanner.



9. Install two new 'O' Rings (11,26) onto the Pressure Indicator (16). Screw the Pressure Indicator (16) into the Extrair Body (4). Tighten using a 22mm spanner.



10. Fit a new 'O' Ring (6) into the top of the Extrair Body (4).



Fitting of Extrair First Stage Regulator

11. Holding the Cylinder (1) and Extrair Body (4) in a vertical position, insert the serviced Extrair First Stage with the Distance Piece into the top of the Extrair Body.



12. Insert the Spring Clip (5) into the Extrair Body (4). The Spring Clip should be inserted into the Body on the opposite side to the Knob. Gently Tap the Spring Clip (5) into place.



Fitting of Shroud

13. Refit the Shroud (7) around the neck of the Extrair Body (4). The joint of the Shroud (7) should be located at the same side as the Knob. Push the clip of the shroud together until it clicks into place.



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.

Adjusting the First Sage

1. Turn off the cylinder valve by turning the Extrair Knob (19) clockwise. Slowly charge the cylinder to 232bar (3300 psi).



2. Slowly open the cylinder valve, this will remove any particles or contaminants from the first stage.



3. 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.

4. Assuming there are no leaks, 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. Adjust the medium pressure by turning the Spring Adjuster (5,36): Turning in the Spring Adjuster 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 is between 9 and 10 bar, purge the relief valve on and off 10-15 times. After cycling, watch the gauge needle. The first stage MP should “lock-up” between 9 and 10 bar. 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. If the MP creeps upward more than 0.25 bar, then there is a leak. Refer to the troubleshooting table for possible causes.



Final Assembly(see AP5317 Extrair First Stage maintenance manual for reference).

1. With the regulator still pressurised, insert the Load Transmitter (4) into the Diaphragm Clamp (7). Press a new Hydrostatic Diaphragm (2) into the Environmental End Cap (1).



2. Thread the Environmental End Cap (1) onto the Diaphragm Clamp (7) until hand tight. Using the C Spanner (PN AT30), tighten the Environmental End Cap (1) until there is metal to metal contact. Re-check the medium pressure, making sure that it is still between 9 and 10 bar.




3. 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 a properly adjusted second stage installed, slowly open the cylinder valve and pressurise the first stage. Completely Submerge the Extrair unit 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.

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

Please refer to AP5317 DS, US, TEK3 & Extrair First Stage Regulator Maintenance Manual for troubleshooting First Stage problems.

SYMPTOM	POSSIBLE CAUSE	TREATMENT
External air leakage	1. Leak from Valve Indent 'O' Ring (14).	1. Replace 'O' Ring.
	2. PTFE Seal (22) worn or damaged.	2. Replace PTFE Seal.
	3. Leak from Charging Port 'O' ring (11).	3. Replace 'O' Ring.
	4. Indicator Gauge 'O' ring (11) worn or damaged.	4. Replace 'O' Ring.
	5. Gland Nut 'O' Ring (21) worn or damaged.	5. Replace 'O' Ring.
	6. HP Valve Seat in Valve Body (24) is worn or damaged.	6. Replace Valve Body.
	7. Leak from Indicator Gauge 'O' ring (26).	7. Indicator Gauge is faulty replace with new Indicator Gauge.
	8. Leak from Cylinder 'O' Ring (2).	8. Replace 'O' Ring.
	9. Leak from Extrair Body 'O' Ring (6).	9. 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. Very Low Medium Pressure.	2. Adjust Medium Pressure to between 9 and 10 bar.
Regulator constantly pressurized	1. HP Valve (24) is worn or damaged.	1. Replace Valve.

Table 2 - Recommended Tool List

PART NO.	DESCRIPTION	APPLICATION
AP0430	I.P. test gauge	Intermediate pressure testing
AT79	'O' Ring removal pick	'O' Ring removal
AT30	C spanner	Removal of Diaphragm Clamp & End Cap
n/a	Torque wrench, Nm or lbf/ft	Installation of Extrair Body and Cylinder
n/a	24mm Crows Foot attachment	Installation of Extrair Body and Cylinder
AT34	11/16" spanner	Removal and installation of Gland Nut
n/a	24mm spanner	Removal of Extrair Body
AT35	8mm Allen key	Removal and installation of Knob and Valve
n/a	22mm spanner	Removal and installation of Indicator Gauge
AT33	3/4" ring spanner	Removal and installation of Charging Port
n/a	Flat ended screwdriver	Removal and installation of Shroud and Spring Clip



AP0430



AT79



AT30



AT34



AT35





AT33


Crows Foot
Attachment

Notes:

1. Photos not to scale.
2. Actual tools may differ from photos.

Table 3 - Recommended Lubricants & Cleaners

LUBRICANT / CLEANER	APPLICATION	SOURCE
Christo-Lube® MCG-111 (Lubricant)	All 'O' Ring seals	Apeks Marine Equipment Ltd PN AP1495, or Lubrication Technologies 310 Morton Street Jackson, OH 45640, USA (800) 477-8704
<div>  CAUTION: Silicone rubber requires no lubrication or preservative treatment. DO NOT apply grease or spray to silicone rubber parts (eg. Diaphragm, Exhaust Valves.) Doing so may cause a chemical breakdown and premature deterioration of the material. </div>		
Biox (Cleaning agent)	Biological immersion fluid for reusable stainless steel and brass parts.	Solent Divers Ltd 122-128 Lake Rd, Portsmouth, Hants, PO1 4HH
White distilled vinegar (100 gr.) (Cleaning agent)	Acid bath for reusable stainless steel and brass parts.	"Household" grade
<div>  CAUTION: Do not use muriatic acid for the cleaning of any parts. Even if strongly diluted, muriatic acid can harm chrome plating and may leave a residue that is harmful to 'O' Ring seals and other parts </div>		
Liquid dishwashing detergent diluted with warm water (Cleaning agent)	Degreaser for brass and stainless steel parts; general cleaning solution for plastic and rubber	"Household" grade



Cleaning & Lubrication Procedure

General Cleaning of all Parts

1. Place all components in an ultrasonic cleaning bath containing an appropriate cleaning solution, such as Biox.
2. The components should be cleaned for 6 minutes, depending upon their condition. Longer cleaning times may be used if required.
3. Rinse the components in warm fresh water.
4. The components should then be blown dry or left to dry naturally.

Lubrication and Dressing

All 'O' Rings should be lubricated with Christo-Lube® MCG-111. Dress the 'O' Rings with a very light film of grease, and remove any visible excess by running the 'O' Ring between thumb and forefinger. Avoid applying excessive amounts of Christo-Lube grease, as this will attract particulate matter that may cause damage to the 'O' Ring.

Enriched Air Nitrox Use – Outside EEC (European Economic Community) Countries Your Apeks regulator has been prepared for use with Enriched Air Nitrox (EAN) where the percentage of oxygen in the EAN does not exceed 40%. This is possible because each regulator is built to a high standard of cleanliness using EAN compatible components and lubricants. In addition, each regulator design has passed stringent adiabatic compression testing to ensure its safety and compatibility with increased percentages of oxygen. If it is your intention to use your new Apeks regulator with Nitrox EAN (O₂ not to exceed 40%), it is imperative that you maintain the internal cleanliness of the regulator (see section on Care and Maintenance). If it is your intention to use the regulator interchangeably with breathing air, the breathing air should be oxygen-compatible or "hyperfiltered" where the condensed hydrocarbons do not exceed 0.1 mg/m³. Your local authorised Apeks dealer can help you determine whether the breathing air that they provide meets this criterion.

Standard compressed breathing air meeting the EN 12021 standard, often referred to as Grade E in the United States, does not necessarily meet this criterion. Grade E or EN 12021 breathing air may contain a certain level 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 into contact with high-pressure oxygen enriched air, they can pose a very real hazard that can lead to combustion. Therefore, if a regulator has had use with Grade E or EN 12021 breathing air, it should be returned to an authorised Apeks dealer for overhaul service including oxygen cleaning, prior to being put back into nitrox service. Although second stage components are not exposed to high pressure EAN, Apeks recommends that the same cleaning procedures be followed for the complete regulator. This prevents the possibility of cross contamination and guarantees the cleanliness of the entire regulator.

Enriched Air Nitrox Use – Inside EEC (European Economic Community) countries EN 1443-3 and EN13949 In CEE countries, diving with Nitrox/O₂ is controlled by Standards EN 144-3 – Respiratory protective devices - Gas cylinder valves - Part 3: Outlet connections for diving gases Nitrox and oxygen - and EN 13949 – Respiratory equipment - Open circuit self-contained diving apparatus for use with compressed Nitrox and oxygen - requirements, testing, marking.

NOTE : Apeks offers a range of regulators designed and manufactured specially for use with oxygen-enriched mixtures, over 21% and up to 100% oxygen. This range has been certified according to the EN 144-3 and EN 13949 standards and meets the requirements of the adiabatic compression tests. They have received CE certification for this type. For further information on this range, contact your Apeks specialist center.

WARNING : These regulators fitted with special connections should be used only with complementary equipment (tank valves, tanks, pressure gauges, etc.) designed and prepared for use with an oxygen-enriched mixture. These items are marked Nitrox/O₂.

WARNING: If the regulator that you use is fitted with a yoke or DIN connection, it is designed for use only with compressed breathing air (21% oxygen and 79% nitrogen) which meets the EN 12021 standard. DO NOT USE this equipment with other mixtures or with gases containing more than 21% oxygen. Disregarding this rule could result in serious injury or death caused by fire or explosion.

Every Nitrox/O₂ regulator is assembled in a clean workshop, using compatible components and special lubricants. It is important to maintain the interior of the regulator in a clean state. Breathing air used in the production of a mixture should be oxygen compatible and double filtered with a hydrocarbon content not greater than 0.1 mg/m³. Your Apeks technical specialist should be able to help you determine if the breathing air he supplied meets these criteria.



WARNING: Please check the regulations regarding Nitrox in your particular country as this may differ from Apeks standard policy.

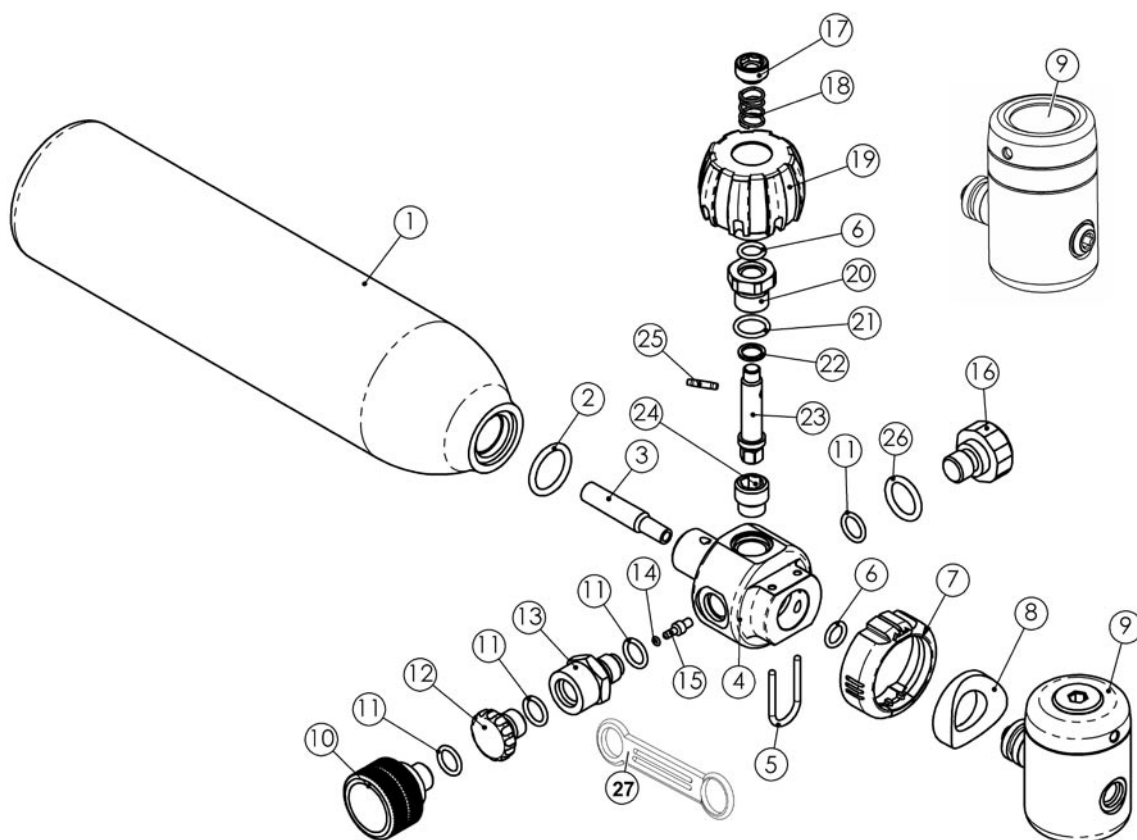
Table 4 - Torque Specifications

PART NUMBER	DESCRIPTION / KEY NUMBER	TORQUE
AP6500	Extrair Body	65 Nm / 48 lbf/ft

Table 5 - Test Bench Specifications

TEST	CONDITION	ACCEPTABLE RANGE
Leak Test	Inlet pressure 150 - 232 bar	No Leaks allowed
Medium Pressure	Inlet pressure 150 - 232 bar	9 to 10 bar
Medium Pressure Creep	Inlet pressure 150 - 232 bar	0.25 bar max for 15 seconds after purging regulator

Extrain Exploded Parts Diagram



* All marked items must be replaced when serviced.

1	AP6513/GQ	Green 0.4lt Cylinder	14*	AP6403	'O' Ring
	AP6513/B	Black 0.4lt Cylinder	15	AP6506/1	Valve Indent
2*	AP1628	'O' Ring	16	AP6101	Pressure Indicator
3	AP4102	Plastic Anti Rust Tube	17	AP1293	Retaining Nut
4	AP6500	M18 Extrair Body	18	AP4012	Spring
5	AP6504	Spring Clip	19	AP6505	Extrain Knob
6*	AP1409	'O' Ring	20	AP6503	Gland Nut
7	AP6508	Shroud	21*	AP1410	'O' Ring
8	AP1446	Distance Piece	22*	AP4010	PTFE Seal
9	AP0513	Extrain First Stage US	23	AP4009	Shaft
	AP0514	Extrain First Stage DS	24*	AP4008	Valve
10	AP6512	Charging Adaptor	25	AP4013	Pin
11*	AP1445	'O' Ring	26*	AP1405	'O' Ring
12	AP6511	Charging Cap	27	AP6519	Charging Strap
13	AP6507/1	Charging Body			



EXTRAIR CYLINDER VALVE REGULATOR

MAINTENANCE MANUAL

FOR

AUTHORISED TECHNICIANS

Apeks Marine Equipment Ltd
Neptune Way, Blackburn, Lancs, England, BB1 2BT