AQUA LUNG

Authorized Technician

TECHNICAL MAINTENANCE MANUAL

LEGEND FIRST STAGE

Rev. 7/2002

Contents

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INTRODUCTION

This manual provides factory prescribed procedures for the correct service and repair of the Aqua Lung Legend first-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 authorized training through an Aqua Lung Service & Repair Seminar. If you do not completely understand all of the procedures outlined in this manual, contact Aqua Lung 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 emphasize important points, tips, and reminders.*

SCHEDULED SERVICE

If the regulator is subjected to less than 50 dives per year, it is permissible to overhaul it every other year with an inspection procedure being performed on the “off” years. For example:

Year #1: Inspection; Year #2: Overhaul; Year #3: Inspection
Year #4: Overhaul, and so on.

Both Inspections and Overhauls need to be documented in the *Annual Service & Inspection Record* in the back of the Owner’s Manual to keep the *Limited Lifetime Warranty* in effect.

If a regulator is subjected to more than 50 dives per year, it should receive the complete overhaul.

An Official Inspection consists of:

1. A pressurized immersion test of the entire unit to check for air leakage.
2. Checking for stable intermediate pressure that is within the acceptable range.
3. Checking for opening effort that is within the acceptable range.
4. Checking for smooth operation of the control knob and venturi switch.
5. A visual inspection of the filter for debris or discoloration.
6. A visual inspection of the exhaust valve to see that it is in good shape and that it’s resting against a clean surface.
7. A visual inspection of the mouthpiece looking for tears or holes.
8. Pulling back hose protectors and checking that the hoses are secure in the hose crimps.

If a regulator fails item #1,2,3 or 4 the entire regulator should be overhauled. If a regulator fails 4,5,6 or 7 it will be up to the technician’s discretion whether or not a full overhaul is required.

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 before attempting to disassemble the first-stage, and to learn which specialty tools and replacement parts will be required. 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. The regulator body will need to be secured in a vise when removing certain threaded parts, including the inlet fitting (30) and spring retainer (31). NEVER SECURE THE REGULATOR BODY DIRECTLY IN A VISE. Instead, install a vise mounting tool (PN 100395) into the high pressure port, then secure the vise mounting tool in the vise. If you do not have a vise mounting tool, use an EXPIRED CO_2 cartridge attached to a high pressure adapter (3/8" female to 7/16" male). Never screw a CO_2 directly into a low pressure port in case the neck of the CO_2 cartridge breaks off, leaving the threads stuck in the regulator.
3. As the regulator is disassembled, reusable components should be segregated and not allowed to intermix with nonreusable parts or parts from other units. Delicate parts, including inlet fittings and crowns which contain critical sealing surfaces, must be protected and isolated from other parts to prevent damage during the cleaning procedure.
4. Use only genuine Aqua Lung parts provided in the Legend first-stage overhaul parts kit (PN 900014). DO NOT attempt to substitute an Aqua Lung 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.

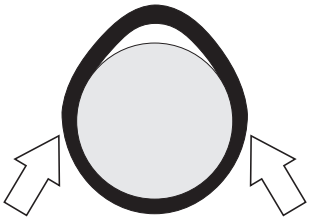
GENERAL CONVENTIONS

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

1. When instructed to *remove*, *unscrew*, or *loosen* a threaded part, turn the part counterclockwise.
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) if possible, or use a brass or plastic o-ring removal tool. Avoid using hardened steel picks, as they may damage the o-ring sealing surface. All o-rings that are removed are discarded and replaced with brand new o-rings.
4. The following acronyms are used throughout the manual: MP is Medium Pressure; HP is High Pressure; IP is Intermediate Pressure.
5. Numbers in parentheses reference the key numbers on the exploded parts schematics. For example, in the statement, "...remove the o-ring (8) from the...", the number 8 is the key number to the crown o-ring.

Pinch Method

Press upwards on sides of o-ring to create protrusion. Grab o-ring or insert o-ring tool at protrusion to remove.



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 or brass o-ring removal tool (PN 944022) 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.

1. Remove the hoses from the first stage using the appropriate sized wrenches. Install spare HP and MP port plugs into the empty ports, except for one MP port and one HP port.
2. Using your fingers, unscrew the cap (29). Lift off the ribbed washer (26).

3. With your fingers, remove the secondary diaphragm (28). Turn the first stage over so the piston (27) falls out into your hand.

4. With your fingers, stretch the spacer (25) and slide it off the spring retainer (21).

5. Using an 8mm hex wrench, unscrew and remove the adjustment screw (24). Remove the washer (23). Lift out the main spring (22).

Note: *The washer may be inside the adjustment screw. If so, gently tap the adjustment screw against the work bench and the washer will fall out.*

6. Install a vise mounting tool (pn 100395) into one of the HP ports. Secure the vise mounting tool in a bench vise with the spring retainer (21) facing upward. Using a 32mm open-end wrench, unscrew the spring retainer from the body. Lift out the spring pad (20). Using a brass O-ring tool, remove the thrust washer (19b). Remove the first-stage from the vise.

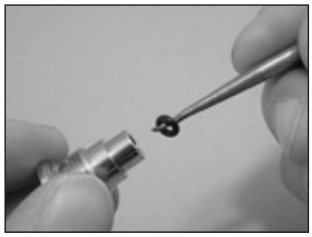
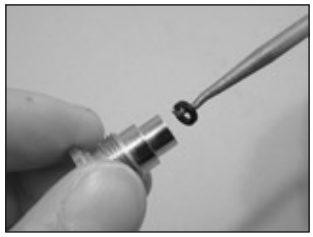


7. To remove the diaphragm (19a), insert a low pressure air nozzle into the open MP port. While holding your thumb over the diaphragm, inject a small blast of air into the MP port to pop out the diaphragm. Lift out the pin support (18). Turn the regulator over and allow the pin (7) to fall out into your hand.



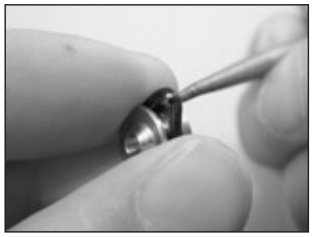
8. Using an 8mm hex wrench, unscrew the HP plug (1). Turn the reglator over so the spring (5) and HP seat (6) fall out into your hand. Separate the spring from the HP seat.


9. Remove the o-ring (2) from the HP plug (1). Using a brass o-ring tool, remove the o-ring (4) and backup ring (3) from inside the HP plug.

CAUTION: Before proceeding, make sure you are woking over a padded work surface; otherwise, the crown (9) may be damaged during removal.

10. Insert the pin-end of seat extractor tool (pn 109436) into the center hole on the low pressure side (diaphragm side) of the first stage body. While keeping the pin slightly tilted, press inward to remove the crown (9). Remove the o-ring (8) from the crown.

If the first-stage has a yoke, go to step 11A; if it has a DIN connector, go to step 11B.

11A. Removing the Yoke

a. Secure the vise mounting tool into a bench vise with the yoke facing upward. Unscrew the yoke screw (34) and remove the dust cap (35) from the yoke screw. Using a large (15") adjustable wrench, unscrew the inlet fitting (30). Loosen the vise and remove the first stage. Remove the vise mounting tool from HP port.

b. Using circlip pliers, squeeze the c-clip (32) and remove it from the inlet fitting. Turn over the inlet fitting and allow the filter shield (31) to fall out into your hand.

c. Insert the plastic end of the seat extractor tool into the open end of the inlet fitting and push out the filter (12). Remove the filter o-ring (13).

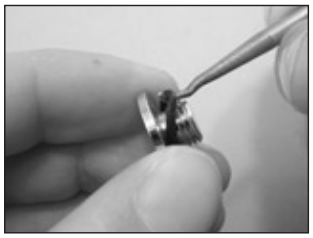
11B. Remove the DIN fitting

a. Secure the vise mounting tool into a bench vise with the DIN adapter facing upward. Remove the protective DIN cap (36). Using a 6mm hex wrench, unscrew the DIN connector (38). Remove the handwheel (39).

b. Using an 1/8" wooden dowel or similar sized tool, push the filter (12) out of the DIN connector. Remove the filter o-ring (13).

c. Remove the o-ring (37) from the face of the DIN connector.

12. Loosen the vise and remove the first stage. Remove the vise mounting tool from HP port. Using a 4mm hex wrench, remove all the port plugs (15 & 17) and their o-rings (14 & 16).



13. Pull on the narrow end of the protective sheath (11) and slide it off the body (10).

This Ends Disassembly

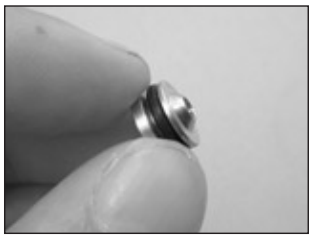
Before starting reassembly, perform parts cleaning and lubrication according to the procedures outlined in Procedure A, titled Cleaning & Lubrication, on page 14.

REASSEMBLY PROCEDURES

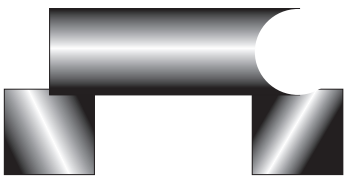
1. Slide the protective sheath (11) on the first stage body (10). Make sure all the ports and inlet fitting opening align with the holes in the sheath.


2. Install new, lubricated o-rings (14 & 16) on all the port plugs (15 & 17). Install all the port plugs, except for one HP port, and tighten them using a 4mm hex wrench.


3. Install a new, lubricated o-ring (8) onto the crown (9). Slide the crown onto the seat installation tool with the sealing edge against the plastic handle. Insert the crown into the body and press it into place. Use the blunt end of the seat installation tool to make sure the crown is properly seated.




NOTE: Before proceeding, closely examine the new backup ring (3). You will notice that one side is flat and one side is concave. When properly installed, the concave side will be against the o-ring (4) as shown in the illustration below.



8. Turn the regulator over so the medium pressure side is facing upward. Drop the pin (7) through the center hole. Place the pin support (18) over the pin. Press on the pin support a few times. It should feel like a spring-loaded button.


9. Press a new diaphragm (19a) into the first stage body. Run your finger around the edge of the diaphragm to make sure it is properly seated. Install the thrust washer (19b) on top of the diaphragm and make sure it is seated flat against the diaphragm.


10. Place the spring pad (20), flat side down, in the center of the diaphragm. Set the main spring (22) on the spring pad. Place the washer (23) on top of the spring.


11. Thread the adjustment screw (24) into the spring retainer (21) until the first two threads are engaged. Thread the spring retainer onto the body until hand tight.


12. Screw a vise mounting tool into the open HP port and secure it in a vise with the spring retainer facing upward. Attach a 32mm crows-foot to a foot-pound torque wrench. Tighten the spring retainer to 18-20 foot-pounds.

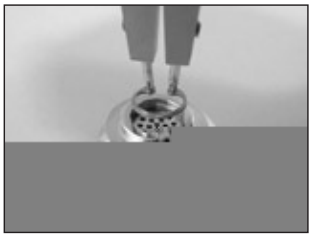
13. Using an 8mm wrench, tighten the adjustment screw (24) until there are 2 to 3 threads still visible above the inside ledge of the spring retainer.

If the first-stage has a yoke, go to step 14A; if it has a DIN connector, go to step 14B.

14A. Installing the Yoke:

a. Insert the conical end of the filter (12) into the threaded end of the inlet fitting (30). Install a new, lubricated o-ring (13) into the end of the inlet fitting, around the filter.


b. Place the filter shield (31) into the end of the inlet fitting. Using circlip pliers, compress the c-clip (32) and install it into the inlet fitting. Inspect the c-clip to make sure it is properly seated.

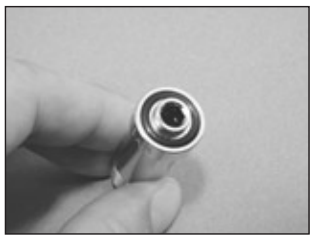
c. Remove the first-stage from the vise. Hold the first-stage with the inlet opening facing downward. Pass the inlet fitting (30) through the yoke (33) and screw it into the first stage body until finger tight. Secure the first-stage back in the vise with the yoke facing upward. Place the special inlet socket (pn 111001) over the inlet fitting. Attach

a socket extension to a foot-pound torque wrench. Pass the socket extension through the top of the yoke and insert it into the socket. Tighten the inlet fitting to 18-20 foot-pounds. Remove the torque wrench and socket.

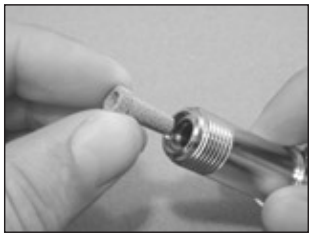
d. Slide the dust cap (35) over the yoke knob threads with the Aqua Lung logo facing outward. Thread the yoke screw (34) into the yoke.

14B. Installing the DIN Adapter

a. Install a new o-ring (37) into the face of the DIN connector.



b. Insert the conical end of the filter (12) into the threaded end of the DIN connector (38). Install a new, lubricated o-ring (13) into the end of the DIN connector, around the filter.



c. Remove the first-stage from the vise. Hold the first-stage with the inlet opening facing downward. Insert the threaded end of the DIN connector through the threaded side of the handwheel (39) and screw it into the first stage body until finger tight. Secure the first-stage back in the vise with the DIN connector facing upward. Screw the DIN connector into the body (10). Attach a 6mm hex key to a foot-pound torque wrench. Tighten the DIN connector to 18-20 foot-pounds.

15. Loosen the vise and remove the first-stage. Remove the vise mounting tool and reinstall the HP port plug.

ADJUSTING THE FIRST STAGE

1. Attach a LP test gauge (0 to 400 psig) to a low pressure hose and thread the hose into the open MP port. If your test gauge does not have an over-pressure relief valve, you must also attached a properly adjusted second-stage to the first stage to act as the relief valve in case of a HP leak.
2. Attach the first stage to a fully charged (2500 to 3000 psi) cylinder. Slowly open the cylinder valve to pressurize the cylinder.

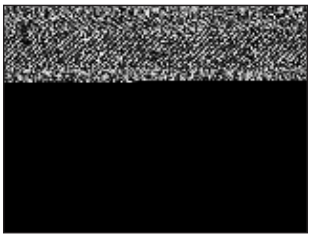
CAUTION: If the pressure gauge rapidly exceeds 140 psi, then there is a HP leak. Quickly close the cylinder valve and purge the regulator. Refer to the troubleshooting table for the causes of HP leaks.

3. Assuming there are no leaks, adjust the medium pressure by turning the adjustment screw: Turning in the adjustment screw increases the MP; turning out the adjustment screw decreases the MP. Turn the adjustment screw in 1/ th turn increments and cycle the relief valve several times after each adjustment. When the MP is 135 psi, cycle the gauge relief valve on and off 10-15 times. After cycling, watch the gauge needle. The first stage MP should "lock-up" at 135 psi. Make any adjustments as necessary. Allow the first-stage to stay pressurized for several minutes and check the MP again to make sure it remains "locked-up" at 135 psi. If the MP creeped upward more than 3 psi, then there is a leak. Refer to the troubleshooting table for possible causes.

4. Close the cylinder valve and depressurize the regulator by opening the gauge relief valve or by pressing the second stage purge button. Close the gauge relief valve and repressurize the system. The MP should still read 135 psi. If the pressure reading is different than the original setting, repeat steps 3 and 4 until the MP is stable.

FINAL ASSEMBLY

1. Orient the spacer (25) so the side with straight edges is facing upward. Align the straight edges of the spacer (25) with the wrench flats on the spring retainer. Work the spacer over the spring retainer until it sits against the body. Place the ribbed washer (26) on top of the spacer



☞ *NOTE: Steps 2 and 3 must be performed while the regulator is still pressurized.*

2. With the regulator still pressurized, insert the piston (27) into the dry chamber. With the cupped side of the secondary diaphragm (28) facing downward, insert the edge of the diaphragm into the outer groove in the spring retainer (21).

3. Thread the end cap (29) onto the dry chamber until handtight. Recheck the medium pressure to make sure it is still at 135 psig.

4. Close the cylinder valve and depressurize the regulator. Remove the test gauge and reinstall the port plug(s).

This Ends Resassembly

Table 1 - Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
High pressure creep (also causes second-stage leaks)	1. HP Seat (6) is worn or damaged	1. Replace HP seat
	2. Crown (9) damaged.	2. Replace crow
	3. O-ring (4) damaged or worn.	3. Replace O-ring
	4. HP plug (1) internal wall damaged	4. Replace HP plug
	5. O-ring (8) damaged or worn	5. Replace O-ring
	6. Body to crown sealing area damaged	6. Replace Body
External air leakage -0r- Secondary diaphragm distended or burst	1. Port plug o-rings (14 & 16) worn or damaged	1. Replace o-rings
	2. Diaphragm (28) worn or damaged	2. Replace diaphragm
	3. Diaphragm (19a) worn or damaged	3. Replace diaphragm
	4. Diaphragm seating surface damaged	4. Replace body
	5. Spring retainer (21) loose	5. Tighten spring retainer
	6. Inlet fitting O-ring (13) worn or damaged	6. Replace o-ring
	7. HP Plug o-ring (2) worn or damaged	7. 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 needs service	2. Switch to different cylinder
	3. Filter (12) is clogged	3. Replace filter

Table 2 - Recommended Tool List

PART NO.	DESCRIPTION	APPLICATION
111610	I.P. test gauge	Intermediate pressure testing
944022	O-ring tool, set	O-ring removal and installation
111100	Reversible snap ring pliers	Circlip removal
109436	Seat extract/install tool	HP seat removal
100395	Vise mounting tool	Mounting first-stage into vise
111001	Yoke nut socket	Inlet fitting
n/a	Torque wrench, foot-pound	Inlet fitting, spring retainer, HP Plug
n/a	Socket Extension	Socket
n/a	15" adjustable	Inlet Fitting
n/a	4mm hex wrench	Port plugs
n/a	8mm hex wrench	IP adjustment, HP Plug (removal)
n/a	8mm hex key	HP Plug (installation w/torque wrench)
n/a	6mm hex wrench	DIN Connector (removal)
n/a	6mm hex key	DIN Connector (installation w/torque wrench)

Table 3 - Recommended Lubricants & Cleaners

LUBRICANT / CLEANER	APPLICATION	SOURCE
Christo-Lube® MCG-111	All O-rings seals	Aqua Lung, PN 820466, or Lubrication Technologies 310 Morton Street Jackson, OH 45640 (800) 477-8704
Oakite #31	Acid bath for reusable stainless steel and brass parts.	Oakite Products, Inc. 50 Valley Road Berkeley Heights, NJ 07922
White distilled vinegar (100 gr.)	Acid bath for reusable stainless steel and brass parts.	"Household" grade
Liquid dishwashing detergent (diluted with warm water)	Degreaser for brass and stainless steel parts; general cleaning solution for plastic and rubber	"Household" grade

CAUTION: Silicone rubber requires no lubrication or preservative treatment. DO NOT apply grease or spray to silicone rubber parts. Doing so may cause a chemical breakdown and premature deterioration of the material.

CAUTION: DO NOT use muriatic acid for the cleaning of any parts. Muriatic acid, even when strongly diluted, can harm chrome plating, and may leave a residue that is harmful to O-ring seals and other parts.

Procedure A
Cleaning & Lubrication
(All Aqua Lung Regulators)

Brass and Stainless Steel Parts

1. Preclean in warm, soapy water* using a nylon bristle tooth brush.
2. Thoroughly clean parts in an ultrasonic cleaner filled with soapy water. If there are stubborn deposits, houshold white distilled vinegar (acetic acid) in an ultrasonic cleaner will work well. DO NOT place plastic, rubber, silicone or anodized aluminum parts in vinegar.
3. Remove parts from the ultrasonic cleaner and rinse with fresh water. If tap water is extremely “hard,” place the parts in a bath of distilled water to prevent any mineral residue. Agitate lightly, and allow to soak for 5-10 minutes. Remove and blow dry with low pressure (25 psi) filtered air, and inspect closely to ensure proper cleaning and like-new condition.

Anodized Aluminum, Plastic & Rubber Parts

Anodized aluminum parts and parts made of plastic or rubber, such as box bottoms, box tops, dust caps, etc., may be soaked and cleaned in a solution of warm water mixed with mild dish soap. Use only a soft nylon toothbrush to scrub away any deposits. Rinse in fresh water and thoroughly blow dry, using low pressure filtered air.

CAUTION: Do not place plastic and rubber parts in acid solutions. Doing so my alter the physical properties of the component, causing it to prematurely degrade and/or break.

Hoses

If buildup of corrosion is severe, it is permissible to soak only the hose fittings in the ultrasonic cleaner as needed, and not allow any solution to enter the hose. Rinse in fresh water and allow to dry with the cleaned ends hanging down. Blow filtered air through them prior to installing onto the regulator.

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.

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

Table 4 - Torque Specifications

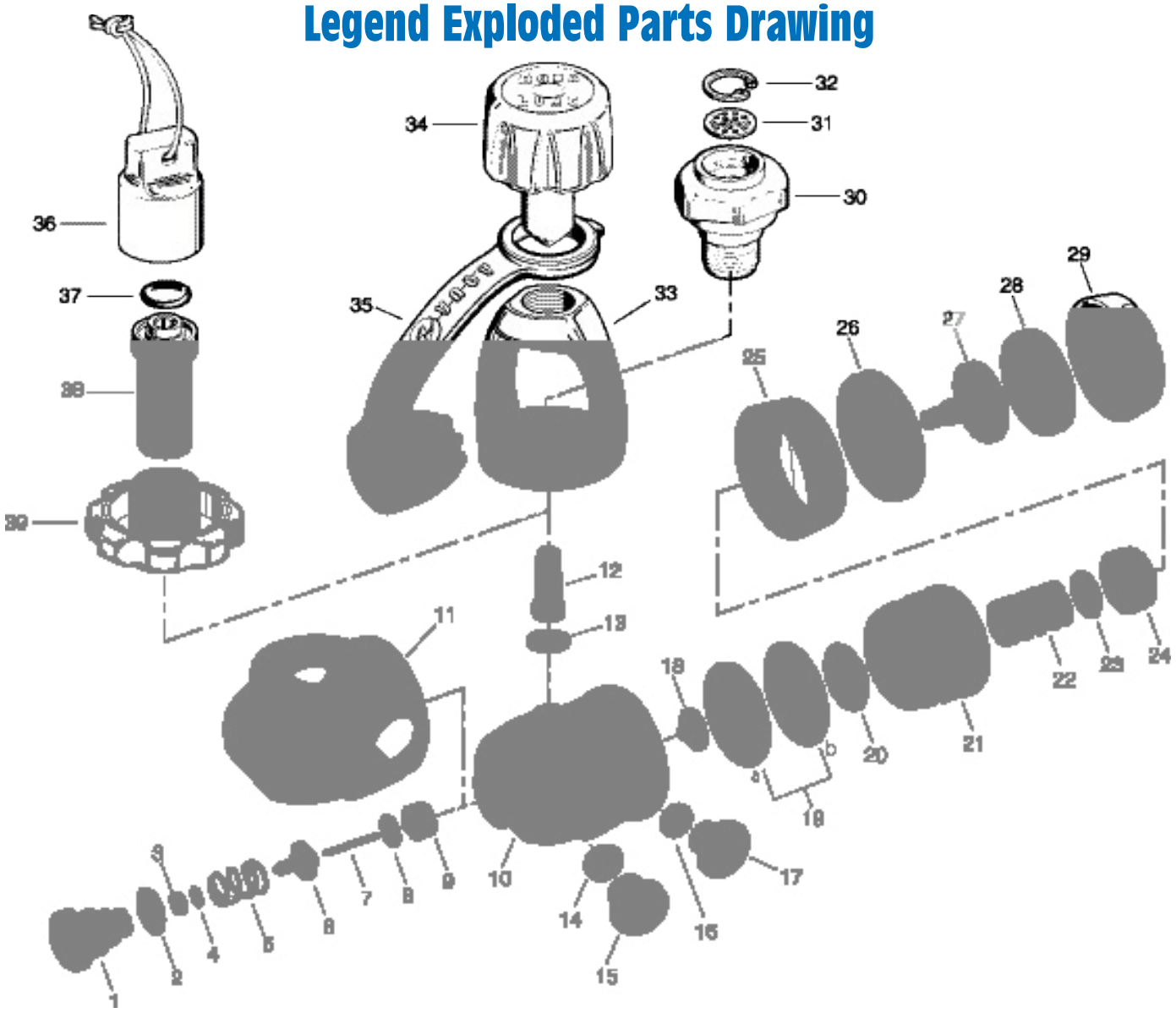
PART NUMBER	DESCRIPTION (KEY NUMBER)	TORQUE
716021	Spring retainer (21)	25±2 foot-lbs
716018	Inlet Fitting (30)	20±2 foot-lbs
124602	DIN Connector (38)	20±2 foot-lbs
129120	HP Plug (1)	43-45 inch-pounds
129118, 129119	HP Port Plug (15), LP Port Plug (17)	16-18 inch-pounds

Table 5 - Test Bench Specifications

TEST	CONDITION	ACCEPTABLE RANGE
Leak Test	Inlet 2,500-3,000 (±100) psig	No leaks allowed
Medium Pressure	Inlet 2,500-3,000 (±100) psig	135±5 psi
Medium Pressure Creep	Inlet 2,500-3,000 (±100) psig	5 psi max between 5 to 15 seconds after cycling (purging) regulator

TECHNICIAN'S NOTES

Legend Exploded Parts Drawing



Key #	Part #	Description
------	129060	First Stage Complete
------	***900014***	***Overhaul Parts Kit (Yoke and DIN)***
1 -----	129120	HP Plug
2 -----	***824407***	***O-ring***
3 -----	***119129***	***Backup ring***
4 -----	***820080***	***O-ring***
5 -----	122244	Spring
6 -----	***105940***	***HP Seat***
7 -----	102002	Pin
8 -----	***820038***	***O-ring***
9 -----	106027	Crown
10 ----	129111	Body
11 ----	129112	Sheath
12 ----	***129151***	***Filter***
13 ----	***820011***	***O-ring***
14 ----	***820072***	***O-ring, HP Port***
15 ----	129118	Port Plug, HP
16 ----	***820011***	***O-ring, LP Port***
17 ----	129119	Port Plug, MP
18 ----	129121	Pin Support
19 ----	***103425***	***Diaphragm Kit (includes thrust washer)***
20 ----	124560	Spring Pad
21 ----	129122	Spring Retainer
22 ----	106356	Main Spring

Key #	Part #	Description
23 ----	845097	Washer
24 ----	106026	Adjustment Screw
25 ----	129128	Spacer
26 ----	129127	Ribbed Washer
27 ----	129123	Piston
28 ----	129126	Diaphragm, Secondary
29 ----	129114	Cap
30 ----	129124	Inlet Fitting
31 ----	129149	Shield
32 ----	863051	C-Clip
33 ----	124613	Yoke, Black Chrome
------	106843	Yoke, Satin Chrome
34 ----	107507	Yoke Screw
35 ----	124555	Dust Cap
36 ----	107441	DIN Cap
37 ----	***820094***	***O-ring***
38 ----	129125	DIN Fitting
39 ----	129117	DIN Handwheel

Part numbers in ***BOLD ITALICS*** indicate standard overhaul replacement part.

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