Dry Air Demand

(D.A.D. – Part Number GR400)

First Stage

Service & Repair Guide

GENESIS SCUBA®



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About This Manual

Introduction



As a service technician, you are entrusted with maintaining your customer's equipment to the same standards with which it was manufactured. At Genesis, we are committed to providing you with the tools you will need to accomplish this important task, including the information provided in this manual.

Possession of this manual, however, does not constitute an offer by Genesis Scuba to sell component parts, nor does it qualify you to perform service or repair for Genesis Scuba products. In order to purchase spare parts or perform service and repair, you must be directly employed by an Authorized Genesis Dealer. It is also your responsibility to obtain factory authorized training through your Genesis Scuba distributor.

If you are ever unsure about how to perform any of the procedures outlined in this manual, please contact Genesis Scuba for technical assistance.

Scheduled Service

Regulators should be given the same care and maintenance as life support equipment. It is therefore important to perform scheduled overhaul service for the entire regulator (first and second stages) at least once every year with normal or infrequent use.

A unit that receives heavy or frequent use, however, should be serviced at least twice each year - or more often - depending on the conditions of use and the manner in which it is maintained. (Refer to the maintenance procedures outlined in the Genesis Regulator Owner's Manual.).

When performing service, whether it is a routine overhaul or a repair of a specific problem, it is important to understand how the regulator is designed and how it operates. An illustrated explanation of the D.A.D. first stage design is provided on the following page.

EAN/ Nitrox Service

Genesis regulators can be upgraded for use with oxygen enriched air (EAN/ Nitrox) not to exceed 40% oxygen content. This upgrade must be performed in conjunction with a complete overhaul, and includes a special cleaning procedure that is outlined in this manual.

Use of Warnings, Cautions, & Notes

WARNING indicates a procedure or situation that may result in serious injury or death if instructions are not followed correctly.

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

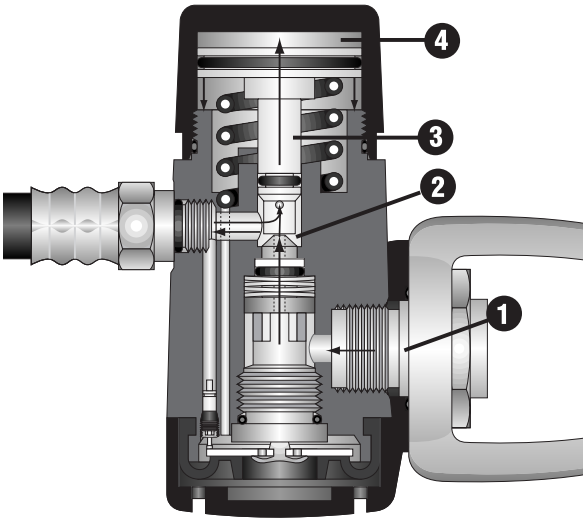
NOTE is used to emphasize important points, tips, and reminders.

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Function & Design

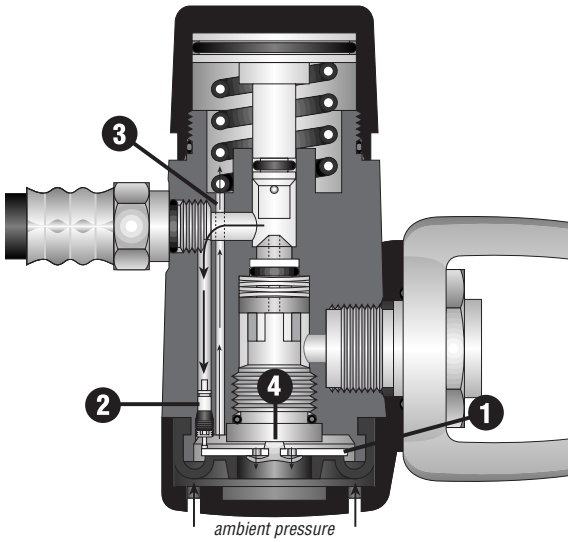
Introduction

The D.A.D. (Dry Air Demand) is a balanced piston first stage with a patented feature that seals out the environment with no messy oils or grease. Here's how it works:



Pressurization & Lockup

- *High pressure air enters through the inlet (1), and travels through the orifice retainer and orifice (2).*
- *While the piston is unseated off the orifice, air travels through the low pressure ports, where it meets the closed valves of the second stages and BC inflator, and quickly travels backward.*
- *At the same time, air enters the small openings in the shaft of the piston (3), just above the HP seat, and flows out the through the piston head.*
- *The air pressure (4) above the piston head is now slightly greater than the combined pressure of the spring and the ambient pressure inside the chamber (5) below the piston head. This causes the piston to move downward, until the HP seat is sealed against the orifice.*
- *Airflow is actuated when a second stage valve opens, causing the intermediate pressure to momentarily drop. This reduces the pressure above the piston head, allowing the spring and ambient pressure to lift the piston off the orifice.*



Dry Air Demand (D.A.D.) Feature

- *As ambient pressure increases with depth, the ambient sensing diaphragm (1) flexes inward, against the ambient pressure (Schrader) valve (2).*
- *As the ambient pressure valve opens, intermediate pressure air is allowed to travel through the valve, and back into the spring chamber surrounding the piston through a separate channel (3). Sea water does not enter the spring chamber.*
- *When pressure inside the spring chamber becomes equal to ambient pressure, the diaphragm flexes away from the ambient pressure valve, causing the valve to shut.*
- *As ambient pressure decreases upon ascent, air inside the spring chamber expands. Excess air escapes through a one-way vent valve (4) built into the ambient sensing diaphragm, until the air inside the spring chamber is equal to ambient once again.*

These actions occur instantaneously in response to the slightest changes in ambient pressure.

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SECTION 1

Facility Requirements

The service facility is perhaps the most important asset of any professional dive store. It should be clean and well lighted, and stocked with a complete inventory of parts and manufacturer's specialty tools for the products your store sells. As a minimum requirement, your service facility should be equipped with the following items:

- ***Ultrasonic Cleaner*** – Select the right size model that can keep up with the volume of regulators that your store services. A built in timer and heater will help control the cleaning time and temperature of the solution, since most solutions work best when heated.
- ***Bench Mounted Vise*** – A vise is sometimes needed to hold the regulator secure – especially when removing the first stage yoke retainer. Special care must be taken, however, to avoid damage that can result from improper use of this tool. Be sure to follow the instructions provided in this manual.
- ***Magnification Lamp*** – Strong lighting and magnification are essential requirements for performing a thorough parts inspection - especially when locating the cause of a small leak.
- ***Quality Wrenches & Sockets*** – When working with brass parts, it is especially critical to use the correct size wrench and to ensure that it fits properly over the part. The use of an adjustable wrench is very likely to cause damage to your customer's regulator, and should be strictly avoided at all times.
- ***Calibrated Inch-Pound Torque Wrench*** – It is important to follow the manufacturer's torque values whenever they are specified, in order to avoid overtightening or under-tightening a part. This is especially important for smaller parts and fittings, when overtightening can easily damage the part.
- ***Calibrated Foot-Pound Torque Wrench*** – Torque wrenches that can be set for both inch-pound and foot-pound measurements generally tend to be less accurate than wrenches that are designed to measure torque within a specific range.
- ***Genesis Specialty Tools*** – Specialty tools are critically important to performing each step of disassembly and reassembly according to factory prescribed procedures. Genesis specialty tools that are required to perform service for the D.A.D. first stage are pictured on the following page.

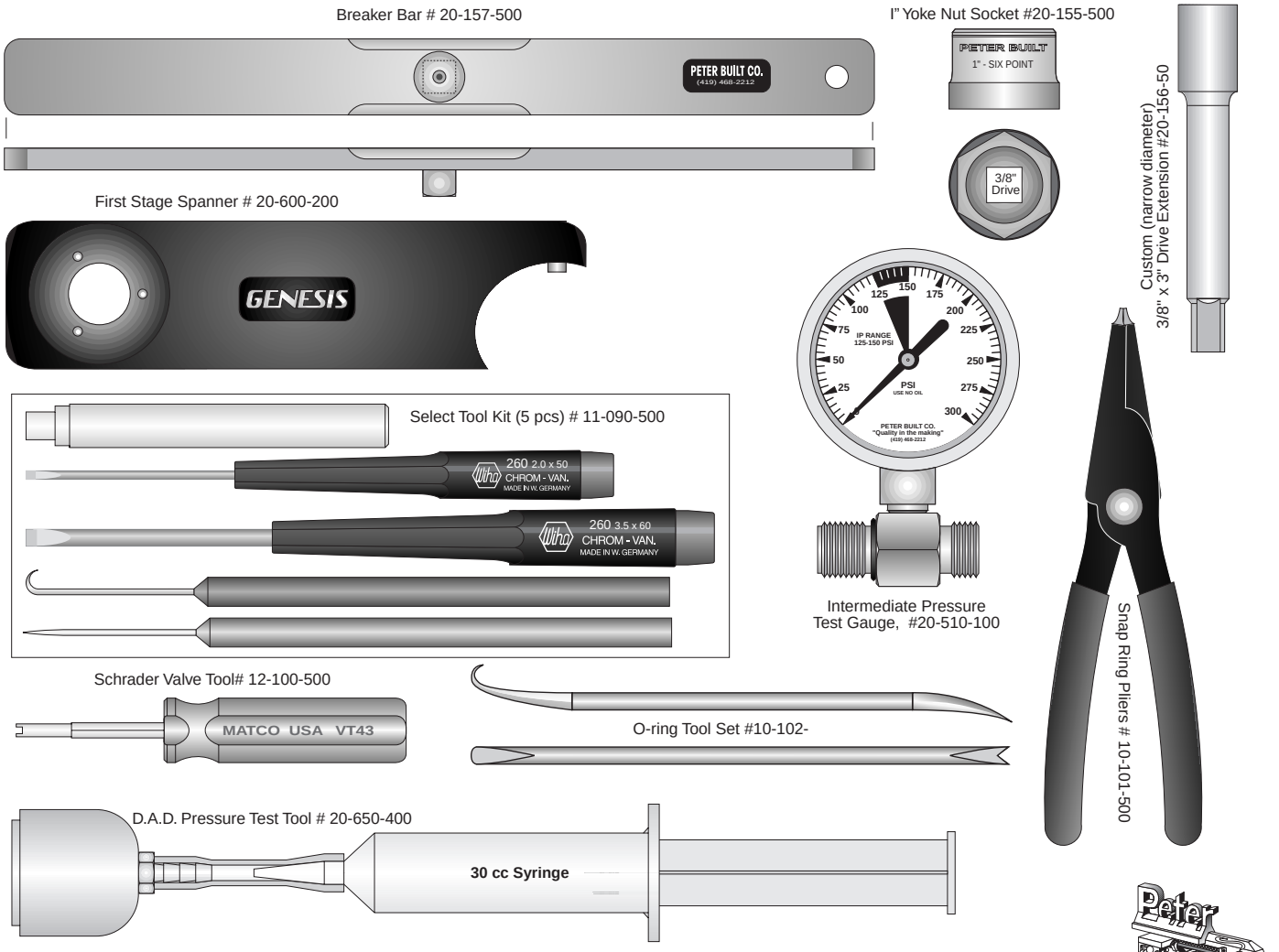
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Table 1 – Recommended Equipment and Suppliers

The specialty tools shown below can be purchased directly from Genesis Scuba. For other items needed to outfit your store's service facility, we recommend the following suppliers:

Peter Built Co. www.scubatools.com	Manufacturer of custom designed specialty tools and test fixtures	Galion, OH 44833 Phone: 419-468-2212
Branson Ultrasonics www.bransoncleaning.com	Manufacturer of tabletop ultrasonic cleaners	Danbury, CT 06813 Phone: 203-796-2298
Lubrication Technology	Manufacturer of **Christo-Lube 111** (Genesis approved lubricant)	Jackson, OH 45640 Phone: (740)286-2644
Lawrence Factor, Inc. www.lawrence-factor.com	Manufacturer of **LFW™ (Lawrence Factor Wash)** (Genesis approved acid bath cleaning solution)	Miami Lakes, Florida 33014 Phone: 305-430-0550
Modern Chemical Ohio Corporation www.a1.com/bluegold	Distributor of **Blue Gold Aqueous Cleaner** (Genesis approved aqueous cleaning solution for EAN/ Nitrox Service)	Batesville, Indiana 47006 Phone: (812) 934-5915
Simple Green www.simplegreen.com	Manufacturer of **Crystal Green Aqueous Cleaner** (Approved alternative aqueous cleaning solution for EAN/ Nitrox Service)	Huntington Harbor, CA 92649 Phone: (800) 228-0709
Sears Roebuck www.sears.com/craftsman	Retail distributor of **Craftsman® tools**	

D.A.D. Specialty Tools



Genesis specialty tools are made in the USA by Peter Built Co. *Illustrations courtesy of Peter Wolfinger.*

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SECTION 2

Preliminary Inspection

External Inspection

1. Closely examine the conical filter to check for any signs that contaminants have entered the system, including sea water, rust, or aluminum oxide.

> **NOTE**: A green discoloration of the filter indicates that moisture has entered the regulator, and internal corrosion has possibly occurred. Other types of discoloration may indicate that the regulator has been used with a corroded cylinder. Advise the customer of this, and the possible need to obtain service for his cylinder.

2. Slide back the hose protectors, if present, to visually inspect the condition of the hoses, especially at their fittings.
3. Closely examine the finish of the first stage to check for any chips, scratches, or other damage that exposes the brass beneath the finish.

> **CAUTION**: Do not clean any parts that show damage to their finish inside an ultrasonic cleaner.

4. Closely examine all parts of the first stage for any other signs of external corrosion.

Immersion / Leak Test

1. Check to ensure that the regulator is fully assembled and connected to a second stage, and that there are no open ports or hoses. Connect the first stage to a cylinder that is filled with 3,000 psi, and open the cylinder valve to pressurize the regulator.
2. If leakage cannot be heard, or if the source of leakage detected audibly is not obvious, immerse the first stage in fresh water to check further for any signs of air leakage, especially at the fittings of hoses.
3. Note the source of any leakage found and refer to *Table 2 - Troubleshooting* to determine its possible cause.
4. Close the cylinder valve and depress the second stage purge button to depressurize the regulator before performing the next procedure.

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Intermediate Pressure Test

NOTE: It is not necessary to perform this test unless a problem has been reported that requires diagnostic troubleshooting and repair. When performing routine overhaul service, proceed directly to the following section, ***Disassembly***.

1. Connect a calibrated intermediate pressure test gauge to the regulator, either with a quick-disconnect inflator hose or with the female fitting of a second stage LP hose, depending on the connection of the test gauge.

CAUTION: To provide a safety relief valve in the event that intermediate pressure exceeds 155-170 psi, ensure that a fully assembled and properly adjusted second stage is connected to the first stage before pressurizing. Failure to relieve intermediate pressure that exceeds 400 psi may result in damage or rupture of the test gauge or LP hose, and could cause serious personal injury.

2. Slowly open the supply valve to pressurize the first stage. Closely monitor the IP test gauge to determine whether the intermediate pressure rises above 145 psi.
3. Note the intermediate pressure indicated by the test gauge, and purge the second stage several times to determine whether lockup is achieved without creeping or fluctuating back and forth.
4. If the intermediate pressure creeps up or otherwise fluctuates after cycling the regulator, wait for it to stabilize (if possible) before making a final note of the intermediate pressure.

NOTE: Correct intermediate pressure for the D.A.D. first stage is 140 (±5) psi, with an inlet pressure between 2,500 - 3,000 psi.

5. Close the supply valve and depress the second stage purge button to depressurize the system before attempting to perform any disassembly.

▼ *After completing the Preliminary Inspection, proceed to* ***Section 3 – Disassembly***

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SECTION 3

Disassembly Procedures

General Guidelines

- *Prior to performing any disassembly, check to ensure that the service facility is well equipped with all the tools and parts needed to perform a complete service from start to finish. DO NOT attempt to perform the service unless all of the required tools and parts are available.*
- *All o-rings are classified as being either dynamic or static.* ***Dynamic*** *o-rings are those which sustain friction and movement, as they are either mounted directly onto a moving part, or create a seal against a moving part.* ***Static*** *o-rings simply create a seal between two non-moving parts, and are therefore less subject to wear than dynamic o-rings. After passing close inspection, static O-rings may sometimes be reused, although this is not necessarily recommended. Dynamic O-rings must be automatically discarded and replaced with every service, regardless of age or appearance.*
- *Refer to the schematic and parts list while performing these procedures. Each part is identified by its reference number shown on the drawing the first time it is referred to in the procedure.*
- *Do not attempt to reuse parts that are designated to be automatically discarded and replaced with the parts provided in the overhaul parts kit. These parts should be shown to the customer, however, to ensure their confidence and satisfaction that complete overhaul service has been performed.*
- *Inspect all reusable parts as directed, either during or immediately following the disassembly procedures. When in doubt, compare the part with one that is new to best determine its condition.*

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CAUTION: Whenever possible, use only plastic or brass O-ring tools for removing O-rings in order to prevent damage to the sealing surface. Steel instruments, such as dental picks, can easily damage the sealing surface of a softer brass part, causing irreparable leakage and requiring the part to be replaced with new.

1. Before disassembling the first stage, remove the low pressure second stage hoses with a 9⁄16" open end wrench, the high pressure hose with a 5⁄8" open end wrench, and the low pressure inflator hose with a ½" (or other size required) open end wrench. Remove all remaining port plugs(22&34) with a 5⁄32" hex key.
2. Remove and inspect the O-rings(23&33) on these items to determine their condition, and discard them if any signs of decay are found.

NOTE: It will be necessary to secure the first stage in a vise in order to perform the following step. To avoid the risk of damage, the preferred method is to mount the first stage outside the vise with the use of a vise mounting tool fastened into the high pressure port (see Fig. 1.) Genesis recommends the Peter Built First Stage Handle (PN 20-115-100). Otherwise, the first stage can be secured directly inside a woodworking vise, provided that it is padded with rubber to protect the finish, and is not overtightened beyond the extent needed to hold the first stage secure. Do not, under any circumstances, fasten the first stage directly between the metal jaws of a bench vise.



Fig. 1 – Recommended Vise Mounting

3. Secure the first stage in a vise as described above, with the yoke(4) and yoke screw(2) facing straight up. Fit the three pin spanner of the First Stage Wrench (PN 30-600-200) over the end cap(32) and rotate slightly in either direction to engage all three pins into corresponding bore holes (see Fig. 2), and hold the tool securely engaged. While maintaining a firm grip on the yoke to prevent the first stage from turning in the vise, turn the end cap counter-clockwise to loosen no more than ¼ turn (90 degrees) so that it can later be removed by hand. Do not loosen it further than ¼ turn at this time.

4. Disassembly of the Yoke Connector

a. Loosen the yoke screw counter-clockwise to create adequate space, and place a 1" Yoke Retainer Socket (PN 20-155-500) inside the yoke and over the hex features of the yoke retainer(8). Pass a Breaker Bar (PN 20-157-500) through the yoke and fit the 3⁄8"

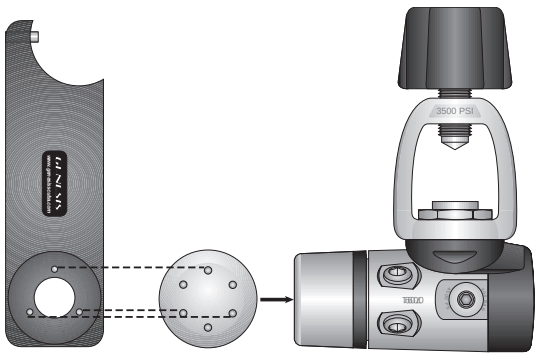


Fig. 2 – End Cap Removal

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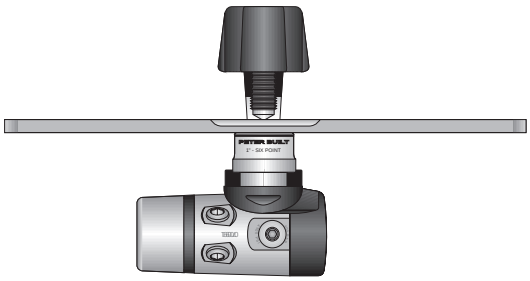


Fig. 3 – Removal of yoke retainer

square drive into the socket. Tighten the yoke screw clockwise until it is lightly snug over the dimpled feature of the breaker bar (see Fig. 3). Then, grasp the breaker bar with both hands on opposite ends and turn the socket counter-clockwise with steady force to loosen. Do not use impact.

CAUTION: The socket and breaker bar combination provide the best insurance against damage while removing the yoke retainer, using the procedure described above. DO NOT, under any circumstances, use an adjustable wrench or an open end wrench that does not fit completely over the flats on both sides. Doing so may result in permanent damage to the yoke retainer, requiring its replacement.



Fig. 4 – Removal of Filter Retaining Ring

b. Loosen the yoke screw counter-clockwise to remove the breaker bar and socket, and remove the yoke screw from the yoke. Remove the dust cap(3), and set these items aside.

c. Turn the yoke retainer counter-clockwise to remove from the body, and set the yoke and first stage aside. Remove the saddle O-ring(10) from the yoke retainer and inspect for any signs of decay. Discard if found. Remove and discard the O-ring(9), and do not reuse.

d. While holding the inlet fitting securely, apply a pair of snap ring pliers (PN 10-101-500) to the retaining ring(5) and squeeze until it has disengaged from the yoke retainer (see Fig. 4). Remove the snap ring from the retainer, followed by the filter(6) and O-ring(7), using a small probe if necessary. Discard both the filter and O-ring, and do not reuse.



Fig. 5 – Removal of DIN Filter Retainer

5. Disassembly of the DIN Connector

a. Re-secure the first stage in the vise with the DIN connector facing straight up.

b. Apply a ¼" hex key to the filter retainer(4b), and turn it counter-clockwise to loosen and remove (see Fig. 5). Remove and discard both O-rings(4a&4c).

c. Lift the handwheel(4f) off the filter housing(4g), and closely inspect the condition of the threads to ensure it is free of any burrs or other damage that could prevent proper threading. Replace the handwheel if damage is found, or set it aside to be reused.

d. Apply a 13⁄16" box wrench to the filter housing, and turn it counter-clockwise with steady force to loosen and remove from the first stage body. Remove and discard the filter(4d) and O-rings(4e).

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6. Remove the first stage from the vise, and remove the vise mounting tool if one was used.
7. While holding the first stage secure in one hand, firmly grasp the saddle(11) and pull it straight off with the other to expose the diaphragm(13) beneath it that contains the vent valve(12). (See Fig. 6.)
   a. Examine the color of the vent valve in the center of the diaphragm to determine whether it is blue, indicating that it is a Revision A part, or black, which indicates it is a current Revision B part (see Fig. 7).



Fig. 6 – Removal of Saddle

NOTE: D.A.D. First Stage regulators manufactured prior to September, 2000 are eligible to receive the installation of a performance upgrade kit during their first annual overhaul service. The D.A.D. Performance Upgrade Kit (PN PK400U) contains several Revision B parts including the diaphragm and vent valve, which are easily identified to determine whether the regulator requires this upgrade. If the diaphragm and vent valves are Revision A parts, it is important to install all the parts provided in the Upgrade Kit during reassembly, in addition to those provided in the D.A.D. Overhaul Parts Kit (PN PK400). Refer to the schematic drawing for a complete list of the parts provided in this upgrade.

8. Peel back the lip of the diaphragm and lift it off the first stage body(21). Discard the diaphragm with vent valve and do not reuse.

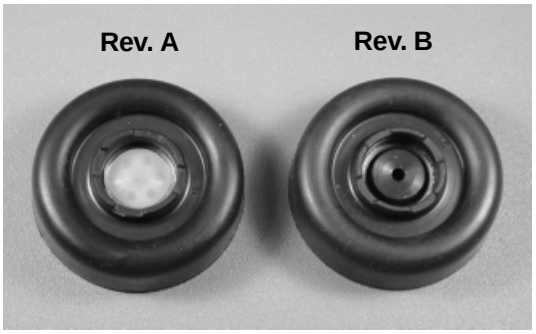


Fig. 7 – Diaphragm/ Vent Valve Revision Identification

NOTE: For normally scheduled overhaul service, the diaphragm with vent valve must be discarded and replaced with new. When performing interim repair service less than six months since the most recent overhaul service, the diaphragm and vent valve may otherwise be reused if found to be Revision B parts in satisfactory condition; free of any tears, decay, or distortion.

9. While holding the vise secure, mate a Schrader® Valve Driver (PN 12-100-500) over the pin and head of the Schrader valve(17). (See Fig. 8.) Turn the valve counter-clockwise to remove and loosen from the first stage body(21). Discard the valve, and do not reuse.
10. Apply a 5⁄32" hex key to the center of the orifice retainer(14), and turn the retainer counter-clockwise to loosen and remove from the first stage body. Remove and discard the O-ring(15).

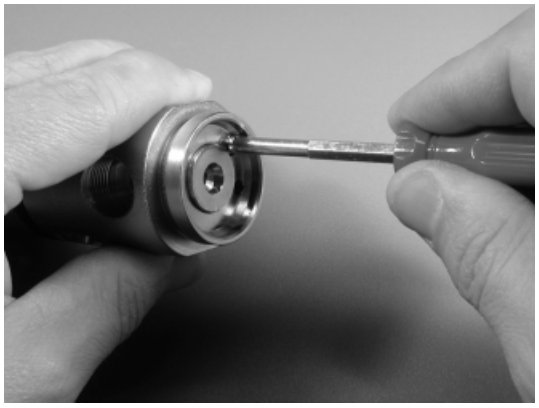


Fig. 8 – Removal of Bleed Valve

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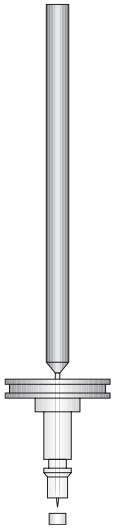


Fig. 9 – Removal of HP Seat

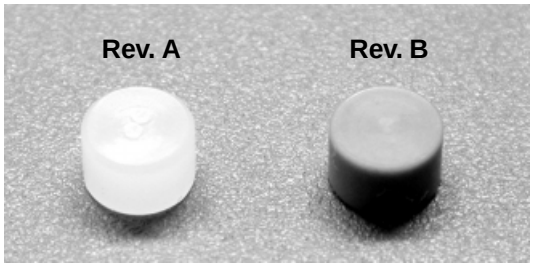


Fig. 10 – HP Seat Revision Identification

11. Firmly grasp the first stage body with one hand and the end cap (pre-loosened in Step 3) with the other, and turn the end cap counterclockwise to loosen completely from the body. Lift the end cap with piston(30) straight up and off the first stage body and spring. Remove the styling ring(24) and discard or set it aside to be reused, depending on its condition.
12. Pull the piston straight out of the end cap, being careful to avoid rocking or twisting it in order to prevent metal against metal contact. Remove and discard both dynamic O-rings(29&31).
13. To remove the high pressure seat(28) from the end of the piston shaft, carefully insert the blunt probe provided in the Select Kit (PN 11-090-500) through the head and shaft of the piston. Firmly press the rod of the tool against the underside of the seat to press it out of the piston shaft (see Fig. 9).
    a. Examine the color of the HP seat to determine whether it is translucent white, indicating that it is a Revision A part, or green, which indicates it is a current Revision B part (see Figure 10). Discard the seat, and do not attempt to reuse.

> **NOTE**: D.A.D. First Stage regulators manufactured prior to September, 2000 are eligible to receive the installation of a performance upgrade kit during their first annual overhaul service. The D.A.D. Performance Upgrade Kit (PN PK400U) contains several Revision B parts including the HP seat, which is easily identified to determine whether the regulator requires this upgrade. If the HP seat is a white Revision A part, it is important to install all the parts provided in the Upgrade Kit during reassembly, in addition to those provided in the D.A.D. Overhaul Parts Kit (PN PK400). Refer to the schematic drawing for a complete list of the parts provided in this upgrade.

14. Remove the high pressure valve spring(27) and spring isolators(26) from the body. Inspect the spring isolators for any signs of damage or distortion, and discard if any is found. Closely inspect the spring with a magnifier to check for any signs of damage or corrosion that has permeated the wall of the metal. Set the spring aside to be reused if it is determined to be in satisfactory condition with no signs of permanent corrosion or damage.

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CAUTION: If damage is found, or if the intermediate pressure was measured lower than 135PSI during preliminary inspection, replace the spring. DO NOT attempt to raise the intermediate pressure by adding spring isolators to compensate for a damaged spring.

NOTE: If corrosion is found on the spring, check the inside of the body and other internal parts to check for any signs that moisture may have entered the first stage. If evidence of moisture is found inside the first stage, it is important to inspect all parts that could provide a possible leak path, either due to damage or improper assembly.

15. Remove and discard the O-ring(25) from the groove below the intermediate pressure end of the body.
16. While holding the first stage body with the high pressure end facing up, carefully insert the rod of the blunt probe (or same size wooden or plastic dowel) up through the center of the body. Press upward to extract the valve orifice(16). (See Fig. 11.)
17. Remove and discard the O-ring(19) from the orifice. Then, take note of the orientation of the four belleville washers(18) in relation to each other, and remove these also. Inspect all four washers to check for any signs of corrosion, and set them aside to be reused if none is found.
18. Closely inspect the sealing surface of the orifice with a strong magnifier to check for any scratches or blemishes (see Fig. 12). If found, discard the orifice and replace with new. Do not attempt to polish the sealing surface.
19. Using a brass O-ring tool, carefully remove the backup ring(20) from inside the body. Discard the backup ring, and do not reuse.
20. Under strong lighting, closely inspect the inner bore and all sealing surfaces of the first stage body with a magnifier, including the intermediate and high pressure ports, and the inlet port. Check to ensure there are no scratches or other damage that could contribute to leakage. If damage is found that is determined to cause irreparable leakage, it will be necessary to discard the first stage body and replace it with new.

▼ *After completing the disassembly of the first stage, proceed to* ***Section 4 – Cleaning Procedures***

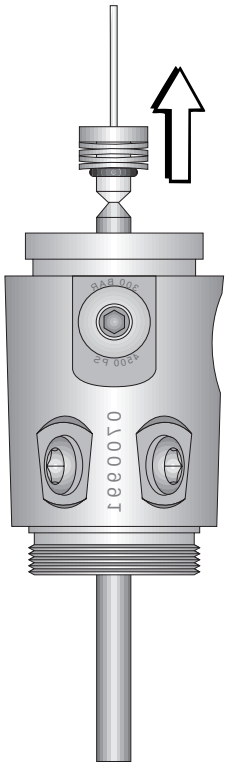


Fig. 11 – Removal of Orifice Assembly



Fig. 12 – Inspection of Orifice

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SECTION 4

Cleaning Procedures

Acidic Cleaning Procedure
(For Equipment Used With Compressed Air)

Introduction

This procedure provides complete instructions for cleaning reusable, non-wearing components and parts of regulators and valves used with standard Grade E compressed air. Acidic Cleaning must also be performed as a prerequisite to performing Aqueous Cleaning — an additional procedure that is necessary for cleaning component parts of equipment used with mixtures of oxygen enriched air (EAN/Nitrox) containing more than 24% oxygen.

Acidic cleaning is a five step procedure that includes:

- *Degreasing and pre-scrub, plastic parts cleaning*
- *Tap water rinse*
- *Ultrasonic acid bath*
- *Sodium bicarbonate neutralizing bath*
- *Distilled or de-mineralized water rinse*

Required Equipment

- **Ultrasonic Cleaner** – Essential to provide the most effective removal of corrosion and scale from metal parts. It is impossible to attain the same level of cleaning with any other method. Preferred features include a built-in timer and a heater.
- **Screen Dip Basket** – Provided with most ultrasonic cleaners, allows the parts to be fully immersed in each solution, and transferred from one container to the next.
- **Separate Containers** – It is important to use four separate containers, including the well of the ultrasonic cleaner, to hold each solution so that the parts can be transferred quickly in the correct sequence and with minimal delay. Each container should be approximately the same shape and size as the well of the ultrasonic cleaner, so that the dip basket fits completely inside.

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STEP 1 – Degrease & Pre-Scrub:

- All reusable non-wearing parts, both plastic and metal, should first be soaked and washed in a solution of 1 quart warm (100º F) water mixed with 3-4 tablespoons of household dish soap (Dawn® or Joy® are recommended). This will loosen and help to remove salt deposits and grime from plastic parts, and remove excessive residues of lubricant grease and grime from metal parts. This step will also extend the life of the acid bath solution by reducing the amount of contamination that occurs during cleaning.
- A nylon brush can be used to scrub stubborn deposits of grime and salt – especially for threaded metal parts and plastic parts.

CAUTION: DO NOT use a steel wire brush. Doing so can damage plating, threads, plastic parts, and sealing surfaces.

STEP 2 – Fresh Water Rinse:

- After completing Step 1, it is important to rinse all parts in fresh tap water to remove any soap residue, in order to prevent contamination of the acid bath solution.
- Step 2 completes the cleaning of all plastic parts.

STEP 3 – Ultrasonic Acid Bath:

CAUTION: It is important to carefully read and understand the Material Safety Data Sheet (MSDS) for any cleaning solution before using it, in order to be aware of the possible hazards associated with its use, and the necessary precautions that must be followed to avoid them.

- Genesis Scuba recommends Lawrence Factor Wash (LFW™) to be used exclusively for the acid bath cleaning of all non-wearing metal parts. LFW can be used in concentrated form, or can be diluted with up to seven parts distilled water to extend the life of the solution.
- For best results, LFW can be warmed to a temperature of approximately 120º F. Follow the directions provided on the label.
- For best results, soak parts in an ultrasonic cleaner for 5 to 15 minutes (depending on the strength of the solution), unless the finish is chipped or scratched. Parts with damage to their finish should be cleaned separately outside the ultrasonic cleaner to avoid agitation.
- Be certain to isolate more delicate parts, such as orifice cones, to prevent metal on metal contact with other parts or the dip basket that can cause damage to sealing surfaces.
- Use a timer to control the cleaning time, and do not leave parts unattended while they are inside the acid bath.

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CAUTION: Harsh acids, such as muriatic acid, may cause damage to parts and must be strictly avoided. Undiluted white vinegar, although less effective, is the only recommended substitute for LFW™.

STEP 4 – Neutralizing Bath:

- Thoroughly mix ⅛ cup sodium bicarbonate (baking soda) with one quart fresh tap water in a clean container. Remove the parts from the acid bath, and immerse in this solution for 2-3 minutes.

STEP 5 – Final Rinse:

- Use only distilled water, to prevent mineral stains on the plated finish of newly cleaned parts.
- Agitate lightly, and then allow to soak for at least 15 minutes.
- Change the rinse often, to maintain a neutral PH.
- Dry the parts afterward with low pressure (50 psi) filtered air.
- Closely inspect all parts afterward to ensure they have been properly cleaned and are in like-new condition.

CLEANING TIPS:

- The yoke screw threads may be dipped into the acid bath, holding the plastic portion out of the cleaner.
- Be certain to isolate parts with critical sealing surfaces, including the orifice, to avoid harmful contact with other metal parts.
- If salt and corrosion buildup is severe around the hose fittings, immerse only the fitting of each hose in the acid bath cleaner, in order to prevent the solution from entering the hose. Rinse thoroughly in fresh water using the same method, and hang the hose to dry suspended in the middle with both ends hanging down. Blow low pressure (50 psi) filtered air through each hose prior to installing it onto the regulator.

NOTE: The parts are now clean for use with standard compressed air, not to exceed 24% oxygen content. Proceed directly to **Section 5 – Reassembly Procedures**, or proceed to the following page for additional cleaning instructions if the regulator will be serviced or upgraded for use with EAN/ Nitrox.

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EAN/Nitrox Cleaning Procedure

(For Equipment Used With Oxygen Enriched Air)

Introduction

Genesis Scuba regulators may be upgraded for dedicated use with mixtures of oxygen enriched air (EAN/Nitrox), not exceeding 40% oxygen. This upgrade must only be performed by an Authorized Genesis Dealer, and requires the installation of the first stage Nitrox overhaul/ upgrade parts kit that is provided specifically for each model first stage regulator (refer to the schematic parts list).

Genesis Nitrox upgrade/overhaul parts kits contain O-rings, seats, and washers made of materials that are proven compatible with oxygen enriched air, up to 40% oxygen. It is very important to replace all standard replacement parts with those provided in each kit, and not to reuse any of them or replace parts individually under any circumstances.

The parts contained in each kit have been specially cleaned and packaged to ensure the absence of contaminants, and must be handled according to the instructions provided in this procedure to avoid accidental contamination.



NOTE: It is important to handle the contents of the Nitrox upgrade parts kits with care, wearing rubber or plastic gloves to prevent contamination with skin oil. In the event that contamination occurs, the parts must be cleaned according to the procedure outlined below.

Prior to the installation of a Nitrox upgrade/ overhaul parts kit, the regulator must undergo a complete overhaul service that includes special cleaning and parts inspection according to the steps outlined in this procedure. Special cleaning is necessary to remove contaminants from the regulator that may react with oxygen enriched air.

Standard compressed air usually contains a certain level of hydrocarbons, including invisible traces of compressor oil, that are not considered harmful or dangerous when kept within the acceptable limits for Grade E compressed air. When these same levels of hydrocarbons come in contact with oxygen enriched compressed air, however, they can pose a very real hazard that can lead to an oxygen fire or explosion. For this reason, it is important to clean the individual parts and components of any regulator or valve before it can be used with enriched air, in order to remove all traces of hydrocarbon contamination.

Although acidic cleaning is very effective for removing corrosion and scale, it is not sufficient by itself to remove certain sources of contamination. It is therefore necessary to perform an additional cleaning procedure that is specifically formulated to remove all traces of silicone grease, skin oil, compressor oil residue, and other hydrocarbon contamination.

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EAN/Nitrox Cleaning is a four step procedure that includes:

- *Pre-Cleaning with Ultrasonic Acid Bath*
- *Ultrasonic Aqueous Cleaning Bath*
- *Distilled or De-mineralized Water Rinse*
- *Final Inspection (direct light, ultraviolet, and wipe test)*

NOTE: Although second stage components are not usually exposed to high pressure oxygen enriched air, Genesis Scuba recommends that the same cleaning and assembly procedures be followed for the complete regulator. This prevents the possibility of cross contamination, and guarantees the integrity of the complete system.

REQUIRED EQUIPMENT:

- ❑ **Dedicated Ultrasonic Cleaner** – To avoid contamination, it is important to use a separate cleaner that is kept dedicated for aqueous cleaning, in addition to one used for acidic cleaning. Preferred features include a built-in timer and a heater.
- ❑ **Screen Dip Basket** – Provided with most ultrasonic cleaners, allows the parts to be fully immersed in each solution, and transferred from one container to the next.
- ❑ **Powderless Latex Gloves** – Skin oil is another source of potential contamination that can react with oxygen enriched air. Once the parts have been cleaned, gloves must be worn at all times to prevent them from becoming contaminated during handling.
- ❑ **Dedicated Rinse Tub** – To avoid recontamination, it is important to use a separate rinse tub that is kept clean and dedicated for aqueous cleaning, in addition to the rinse tub that is used for acidic cleaning.
- ❑ **Incandescent or Fluorescent Lighting –** Required during final inspection to detect more obvious signs of contamination.
- ❑ **Ultraviolet Lighting –** Required during final inspection to detect contamination that is not visible beneath normal lighting.
- ❑ **Lint Free Cotton Wipes –** Required for cleaning and inspection.

Preparing the Workstation

Enriched air cleaning procedures may be carried out in the same work area that is used for servicing air scuba equipment, provided that it is kept reasonably clean, and airborne pollutants (dust, soot, etc.) are not visibly present on surrounding surfaces. Ventilation ducts and windows should be checked to ensure that airflow will not introduce these contaminants while cleaning and service is in process.

- To ensure cleanliness, the work surface should be covered with a clean sheet of butcher paper or plastic sheeting.
- The technician must wear clean, non-powdered latex or plastic gloves whenever handling cleaned parts (including upgrade parts kit), in order to prevent contamination with skin oil.

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NOTE: All tools and fixtures, including the ultrasonic cleaner well, must be kept completely clean of any contaminants. For this reason, a separate set of clean tools should be used for the reassembly of enriched air equipment, different from those used for normal air equipment.

ACIDIC PRE-CLEANING – Before performing aqueous cleaning, parts must first be cleaned with the acidic cleaning procedure outlined on page 15 to ensure the complete removal of any corrosion or scale. Final drying, however, is not necessary.

NOTE: Use only LFW™ cleaning solution, which contains an additional degreasing agent. White vinegar is not an acceptable cleaning agent for EAN/ Nitrox pre-cleaning.

ULTRASONIC AQUEOUS BATH

CAUTION: It is important to carefully read and understand the Material Safety Data Sheet (MSDS) for any cleaning solution before using it, in order to understand the possible hazards associated with its use, and the necessary precautions that must be followed to avoid them.

General Guidelines

- It is important to select an aqueous cleaning solution that is non-carcinogenic, non-toxic, and biodegradable, so that it can be safely disposed of by emptying it into a sewer system that is connected to a waste treatment facility. It must also be non-damaging to the materials of soft wearing parts, including seats, O-rings, washers, and gaskets. Last, it must be easily rinsed away so that it leaves no residue. Refer to Table 1 on Page 4, which lists the aqueous cleaning solution that Genesis Scuba has currently approved.
- The aqueous cleaning solution must be diluted only with distilled water, according to the ratio specified by the manufacturer.
- It is important to pre-heat the aqueous cleaning solution to approximately 130º F.
- The aqueous cleaning solution can be reused at least once, but will eventually require replacement as more contaminants and particulate matter are held in suspension. Frequently examine the appearance of the previously used solution in a clear beaker, and compare it alongside another beaker containing fresh solution in good lighting (diluted with the same ratio of demineralized water). When the appearance begins to vary between fresh and used, or when contaminants can be visually detected, the solution should be disposed of and replaced with new. Whenever in doubt, dispose of the solution and replace with fresh.

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1. Place the parts inside a clean dip basket and lower the basket into the tank of a separate ultrasonic cleaner which contains an approved aqueous cleaning solution. (Refer to Table 1 for an approved and recommended solution, and follow the manufacturer's instructions for dilution rates and recommended working temperatures.) Be certain to isolate more delicate parts, such as orifice cones, to prevent metal on metal contact with other parts or the dip basket that can cause damage to sealing surfaces.
2. Before removing the parts, it is important to don clean powderless latex gloves in order to prevent any subsequent contamination with skin oils. Avoid touching the external surface of the gloves with bare fingers in the process of donning. Without this barrier present, parts will become contaminated with skin oil.

> **NOTE:** It is important to avoid handling clean parts with bare hands while performing the rinsing, inspection, and reassembly procedures. Doing so will re-contaminate the parts with skin oil, and require them to be cleaned again prior to reassembly.

3. With a small, nylon brush and lint-free swabs, scrub all surfaces of each part, and allow to soak for an additional 5-10 minutes before removing from the ultrasonic cleaner. Certain parts with complex features may require more attention - especially those which contain closed recesses and chambers. It is important to ensure that these are thoroughly flushed with solution, and that contaminant residue is not trapped inside.

Demineralized or Distilled Water Rinse:

> **NOTE:** Tap water drawn from the faucet often contains high levels of minerals, and is considered unsuitable for use with aqueous cleaning, either as a diluent or final rinse. Inexpensive filtration systems may be used which easily filter out most minerals, rendering the water "demineralized." For high volume operations, this is a less expensive alternative to bottled distilled water.

1. When immersion in the aqueous cleaner has been completed, it is extremely important to transfer all parts into a clean container filled with fresh distilled or demineralized water that is heated to approximately 140˚ F, to facilitate faster drying. Rinse each part thoroughly with mild agitation to ensure thorough rinsing and the complete removal of cleaning solution. Parts with more complex features will require additional attention to ensure complete rinsing of threads, crevices, and recesses.
2. Dry immediately afterward, using only low pressure (50 psi), hydrocarbon-free gas (Nitrogen or EAN).
3. When drying is completed, set the parts aside on a clean, lint-free surface covered with butcher paper or cellophane.

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Final Inspection:

When each part has been completely cleaned and dried, it must be closely inspected to ensure the total absence of contamination or cleaner residue. In the event that contamination is still found during inspection, it may be necessary to re-clean the part. Inspection is a critical procedure that must be performed in three consecutive steps.

1. Gently wipe all surfaces of each part with a clean, lint-free wipe, and closely inspect both the wipe and part under strong fluorescent or incandescent light to check for any signs of scale, corrosion, damaged plating, burrs, filings, grease, fingerprints, oil, or other contamination. If contamination if found, repeat the above cleaning procedure or replace the part as needed.
2. Assuming no contamination is found, immediately inspect the same part and wipe under ultraviolet light to check for any signs of oils, grease, or fine particulate matter which will fluoresce (glow) if present. If found, repeat the aqueous cleaning procedure.

NOTE: Isolated particles of dust may be eliminated with low pressure, hydrocarbon-free gas.

3. Wrap or cover all metal parts with cellophane or other plastic until ready to begin reassembly.

NOTE: Before proceeding, clean fingertips of latex gloves with isopropyl alcohol to remove any contamination.

4. Examine each replacement parts kit to determine that it has not been previously opened, and that the individual parts have not been exposed to possible contamination, including handling with bare fingers.

WARNING: Do not attempt to use individually ordered spare parts as a substitute for those packaged in kit form directly from Genesis Scuba. Doing so will render the product incompatible for use with enriched air, and may seriously jeopardize the safety of the diver.

5. Closely inspect all new replacement parts for both the first and second stage, including O-rings, seats, filters, and gaskets, under fluorescent and ultraviolet light as prescribed above. Examine the condition of the O-rings to ensure they are in new condition, and do not show any signs of decay. If contamination is found, it will be necessary to re-clean the parts, following the procedures outlined above.

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LOW PRESSURE HOSE ASSEMBLIES

1. Ultrasonically clean both hose fittings by dipping only the hose ends in the LFW™ acid bath, and rinse thoroughly in distilled water.
2. Inspect each fitting to ensure that all scale and corrosion is removed, and re-clean if necessary, using a small nylon brush.
3. Run aqueous cleaning solution through the hose in both directions, checking to ensure that no foreign matter or loose material exits the hose when it is drained. If evidence of internal decay is visible, discard the hose and replace with new.
4. Don clean, powderless latex gloves in order to prevent any subsequent contamination with skin oils. Avoid touching the external surface of the gloves with bare fingers in the process of donning. If contamination of a glove does occur, it can be cleaned with isopropyl alcohol.
5. Ultrasonically clean both fittings inside and out with aqueous cleaning solution, using a soft nylon brush and lint-free swabs to clean all surfaces, including threads, crevices, and recesses.
6. Thoroughly rinse the hose inside and out with heated, demineralized water, to completely remove all traces of aqueous cleaning solution.
7. Direct hydrocarbon-free gas through the hose until it is completely dry inside and out.
8. Inspect the hose according to the inspection procedure outlined in these instructions.
9. Set the hose aside on clean surface, and wrap both fittings with cellophane until it is ready for reassembly onto first and second stages.

HIGH PRESSURE HOSE ASSEMBLY

1. While holding the retaining nut secure at the base of the submersible pressure gauge module with a 9⁄16" open end wrench, apply a separate 9⁄16" open end wrench to turn the hose fitting below it counter-clockwise to loosen and remove the hose.

> ⚠ **CAUTION:** Do not attempt to loosen the hose fitting without holding the retaining jam nut secure, or otherwise attempt to remove the nut. Doing so may result in irreparable damage to the pressure gauge, causing it to flood, and will render its warranty null and void.

2. Carefully remove the high pressure airspool from inside either the HP hose fitting or the retaining nut of the pressure gauge, and set it aside.
3. Closely inspect the gauge module to ensure that the relief plug is present and intact, and that the retaining nut fitting has not been loosened or removed.
4. Gently insert a clean cotton swab into the airspool recesses of both the hose and gauge fittings to wipe out any grease or other deposits.

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5. Using either a brass or plastic O-ring tool, remove both O-rings from the airspool, and discard. Closely inspect the airspool under strong magnification to check for any signs of wear or damage, including chrome loss, scratches, nicks, or cracking—especially on or near the O-ring sealing surfaces. If damage is found, discard the airspool and do not attempt to reuse. Otherwise, the airspool may be cleaned by following the procedure outlined for regulator and valve components, and reassembled with new oxygen compatible O-rings.
6. To ultrasonically pre-clean the pressure gauge fitting, hold the gauge module upright while dipping the fitting in the acid bath for at least 2-5 minutes. Use caution to avoid immersing any portion of the gauge above the fitting, and prevent the gauge from falling into the ultrasonic cleaner.
7. Rinse the gauge fitting in the same manner with distilled or demineralized water, and inspect closely to ensure that all scale and corrosion is removed. Re-clean if necessary.
8. Ultrasonically clean the gauge fitting in the aqueous cleaner as before with the acid bath, using the same caution to avoid immersing any portion of the module above the fitting.
9. Rinse thoroughly by dipping the fitting into distilled or demineralized water, and shake off excess moisture.

CAUTION: Hold the gauge only by the plastic module to avoid touching the fitting with bare fingers.

10. Blow the gauge fitting completely dry, inside and out, with low pressure (50 psi), hydrocarbon-free gas, and set the gauge module aside on a clean surface.
11. Ultrasonically pre-clean both hose fittings by soaking the hose ends in the LFW™ acid bath for 2-5 minutes, depending on the strength of the solution.
12. Dip the hose fittings in distilled or demineralized water, and inspect each fitting closely to ensure that all scale and corrosion is removed. Re-clean if necessary, using a small nylon brush.
13. When the hose fittings have been thoroughly cleaned of scale and corrosion, rinse them thoroughly by swishing in demineralized or distilled water.
14. Using a large syringe or cooking baster, slowly inject aqueous cleaning solution (diluted per manufacturer's recommendations) into the female hose fitting. Refill the syringe or baster and repeat as needed until the hose is full, evidenced by solution exiting through the small orifice on the opposite end. Lay the hose inside the ultrasonic aqueous cleaner to soak for 10-15 minutes.

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15. Don clean, powderless latex gloves in order to prevent any subsequent contamination with skin oils. Avoid touching the external surface of the gloves with bare fingers in the process of donning. If contamination of a glove does occur, it can be cleaned with isopropyl alcohol.
16. Remove the hose from the cleaner, and drain the aqueous cleaning solution from the female fitting. Using a clean syringe, fill the hose completely with distilled water and immerse the entire hose assembly inside a clean container of distilled or demineralized water that is heated to 140-160 ºF. Allow to soak for 15-30 minutes.
17. Remove the hose from the final rinse, and allow to drain. Fill with heated, distilled water until completely full, and allow to drain again. Repeat this several times until the water that drains from the hose contains no residue of the aqueous cleaning solution (i.e., no foam, scent, or color).
18. Shake off any excess moisture, and dry the hose fittings with low pressure (50 psi), hydrocarbon-free gas.
19. Inspect the hose according to the inspection procedure outlined in these instructions.
20. Dress the hose O-ring with clean Christo-Lube®, and install oxygen compatible O-rings onto the male first stage fitting, at the base of the threads. Install the male fitting into the high pressure port of a clean and compatible EAN first-stage regulator (with a second stage connected to serve as a relief valve).
21. Connect the first-stage to a clean cylinder that contains no more than 2,500 psi of hydrocarbon-free gas.
22. While holding the open female fitting of the high pressure hose secure, slowly open the cylinder valve to pressurize the first stage. Allow a steady stream of gas to run through the hose, until no signs of moisture can be seen exiting. Close the cylinder valve, and wrap the open female fitting with a lint free wipe. Re-pressurize, and check the lint free wipe for any traces of moisture. Repeat until no moisture is present.



NOTE: Before proceeding remove gloves and replace with new, or clean fingertips of gloves with isopropyl alcohol.

23. Dress the airspool O-rings with clean Christo-Lube®. Carefully install the O-rings onto the airspool, using caution to avoid damaging each O-ring while passing it over either end.
24. Gently install the airspool into the retaining nut fitting of the pressure gauge by inserting it into the recess.
25. Mate the hose swivel fitting over the airspool and onto the male threads of the gauge retaining nut. Turn the hose fitting clockwise to engage the threads, and turn by hand until snug.

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26. While holding the retaining nut secure with a 9/16" open-end wrench, apply a torque wrench with 9/16" crow-foot to tighten the hose fitting to 50 inch pounds (±5).

CAUTION: Do not attempt to use silicone grease, regardless of grade or manufacturer. Silicone grease is unsuitable for use with enriched air mixtures, and will contaminate the system, rendering it non-compatible with enriched air.

27. Set the high pressure hose with pressure gauge aside on clean surface, and wrap the male fitting with cellophane until it is ready for reassembly onto the first stage.

LUBRICATION & DRESSING:

Perhaps the most critical component of any equipment used with oxygen enriched air is the lubricant grease. Regardless of the application, Genesis Scuba recommends Christo-Lube® MCG-111 (PN MS150) to be used exclusively for the lubrication and dressing of all O-rings and other internal parts. Christo-Lube® provides superior lubrication and protection to that of silicone grease, especially in high pressure (DIN) systems greater than 3,000 psi, and extreme temperature conditions.

CAUTION: Do not attempt to use silicone grease on any component, regardless of grade or manufacturer. Silicone grease is not suitable for use with oxygen enriched air, and will contaminate the entire system, rendering it non-compatible with EAN/ Nitrox.

- Wear clean, powderless latex gloves at all times while handling new O-rings and other parts, to avoid contaminating the parts with skin oil.
- Dress all O-rings with a visible film of Christo-Lube, but avoid applying excessive amounts, as this may attract particulate matter that can cause accelerated wear or damage to the O-ring.
- Set the O-rings aside on a perfectly clean surface that is covered with cellophane. Do not use lubricant that appears to be contaminated with any particulate matter or other foreign debris.

CAUTION: The use of aerosol spray or petroleum based lubricants must be strictly avoided. The propellant gas or petroleum base may attack or weaken plastic or rubber parts, and is not compatible with enriched air.

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Final Adjustment & Flow Testing

When the equipment has been cleaned and reassembled, it is very important to avoid contact with standard compressed air, to prevent any possibility of hydrocarbon contamination. It is therefore extremely important to pressurize only with hydrocarbon-free gas for the purposes of final adjustment and flow testing. As a less expensive alternative to EAN, compressed Nitrogen may be used, purchased from a reputable gas supplier that can certify the gas as being hydrocarbon-free.

> ⚠ **CAUTION**: Do not connect the regulator to any cylinder or air supply that cannot be verified as containing hydrocarbon-free gas. If the regulator is pressurized with standard compressed air, which contains hydrocarbons, it will be rendered incompatible with enriched air mixtures above 24% oxygen until the above cleaning procedure has been repeated.

Labeling & Packaging

After performing the EAN/ Nitrox cleaning and service procedures, it is extremely important to ensure that each piece of equipment serviced is clearly labeled and identified for dedicated use with EAN/ Nitrox. This will help to prevent any crossover use with normal compressed air, and will also help to prevent any accidental use by untrained users.

▼ *After completing the cleaning procedures, proceed to* ***Section 5 – Reassembly***

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Reassembly Procedures

SECTION 5

General Guidelines

- *Refer to the schematic parts list, that highlights automatic replacement parts (ARP) which should be discarded and replaced with new during reassembly. ARP parts are provided in the Annual Service Kit.*
- *Before performing any reassembly, it is important to individually inspect all parts, both new and those that are being reused, to ensure that each part and component is perfectly clean and free of any dust, decay, or blemishes.*
- *Prior to dressing, inspect all O-rings with magnification to ensure they are supple, clean, and completely free of any scoring or decay that would impair proper sealing.*
- *Genesis recommends Christo-Lube® MCG-11 (PN MS150) to be used exclusively for the lubrication and dressing of O-rings and other internal parts. Christo-Lube® provides superior lubrication to that of silicone grease, especially in high pressure (DIN) systems greater than 3,000 psi, and extreme temperature conditions. It is also non-reactive to oxygen, and is approved for use with EAN/Nitrox.*

> ⚠ **CAUTION**: Silicone grease is not compatible with oxygen enriched air, and must be strictly avoided when servicing a regulator that will be used with EAN/ Nitrox. The entire regulator will otherwise become contaminated, and rendered unsafe for use with any mixture of oxygen enriched air.

- *Dress all O-rings with a visible film of Christo-Lube, but avoid applying excessive amounts, as this may attract particulate matter that can cause accelerated wear or damage to the O-ring.*

> ⚠ **CAUTION**: The use of aerosol spray or petroleum based lubricants must be strictly avoided. The propellant gas or petroleum base may attack or weaken plastic or rubber parts.

- *If the regulator has been serviced or upgraded for use with EAN/Nitrox, it is important to don powderless latex gloves before handling any parts, including O-rings, in order to avoid contaminating the parts with skin oil.*

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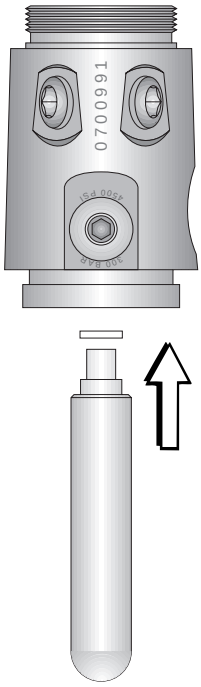


Fig. 13 – Installation of Backup Ring

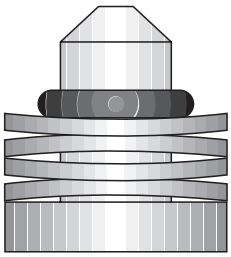


Fig. 14 – Belleville Washer Orientation

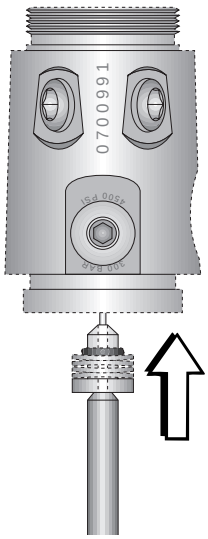


Fig. 15 – Installation of Orifice Assembly

WARNING: DO NOT attempt to use any other manufacturer's part as a substitute for any Genesis part, regardless of any similarity in shape, size, or appearance. Doing so may render the product unsafe, and could result in serious injury or death.

1. Fit the backup ring(20) over the small end of the Backup Ring Tool provided in the Genesis Select Kit (PN 11-090-500). Insert the end of the tool carrying the backup ring into the center of the body(21), through the high pressure end (see Fig. 13). Firmly press the tool straight inward to seat the backup ring, and withdraw the tool. Examine with adequate lighting to ensure that the backup ring is seated evenly inside the body.
2. Closely examine both sides of one of the four belleville washers(18) to identify that it is slightly convex in shape from edge to center. Place one washer directly over the orifice with its outer edge facing down, followed by another washer in the opposite position with its edge facing up. Repeat this sequence to install the following two washers, followed by the O-ring(19). Closely examine when finished to compare the orientation of each washer with that shown in Fig. 14.

CAUTION: The correct orientation of all four belleville washers must be verified before proceeding to the next step. Incorrect orientation and assembly may otherwise impair the regulator's performance.

3. Place the large end of the orifice over the rod of the Blunt Probe provided in the Genesis Select Kit. Carefully insert the rod of the tool into the center of the body, through the high pressure end, and firmly press the tool straight inward to seat the orifice assembly (see Fig. 15). Withdraw the tool and check to ensure it is fully seated inside the body.
4. Install the O-ring(15) onto the orifice retainer(14). Mate the orifice retainer into the center of the ambient chamber inside the high pressure end of the body, and turn it clockwise until finger snug. Apply an inch-pound torque wrench with 5⁄32" hex key socket to tighten to a torque measurement of 90 inch-lbs (±10).
5. Using a Schrader® Valve Driver (PN 12-100-500), guide a new Schrader valve(17) into the threaded hole inside the ambient pressure chamber of the body, located to one side of the orifice retainer (see Fig. 16). Turn the valve clockwise into the body only until it has reached the extent of its thread engagement, and do not tighten beyond snug.

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6. Install the vent valve(12) into the recessed center of the diaphragm(13) by inserting its retaining barb through the hole in the metal disc. Turn the diaphragm over and pull the barb through as needed to seat it securely on the opposite side (see Fig. 17).
7. Roll the edges of the diaphragm back to turn it inside out, and position it over the first stage body so that the retaining barb of the vent valve is facing the center of the orifice retainer. Roll the edges of the diaphragm down on opposite sides so that it is sealed evenly around the groove of the body (see Fig. 18).
8. Place a fingertip over the center of the diaphragm, and tamp down repeatedly to ensure the presence of spring tension as the metal plate of the diaphragm makes contact against the stem of the Schrader valve.
9. Turn the body over to stand it vertical with the intermediate pressure end facing up. Install the O-ring(25) so that it is seated evenly inside the groove at the base of the threads.
10. Generously lubricate and install the piston head O-ring(31) onto the head of the piston, and install the piston shaft O-ring(29) onto the piston shaft.
11. Install the high pressure seat(28) into the end of the piston shaft, and check to ensure it is seated flush with no visible protrusion (see Fig. 19).
12. Set the end cap(32) on a flat surface with the open end facing up. Place the head of the piston inside the cap so that it rests perfectly level above the threads, and then gently press the piston straight down into place until it is fully seated.

> ⚠ **CAUTION:** Be careful to prevent the piston from becoming cocked at an angle as the head travels past the threads of the end cap. The O-ring could otherwise become unseated or damaged, and metal on metal contact could cause damage to the piston or the end cap.

13. Fit the styling ring(24) over the end cap, so that it rests evenly over the circumference of the shoulder.
14. Over the support post inside the intermediate pressure chamber of the first stage body, install the same color (thickness) and number of spring isolators(26) that were disassembled from the high pressure chamber.

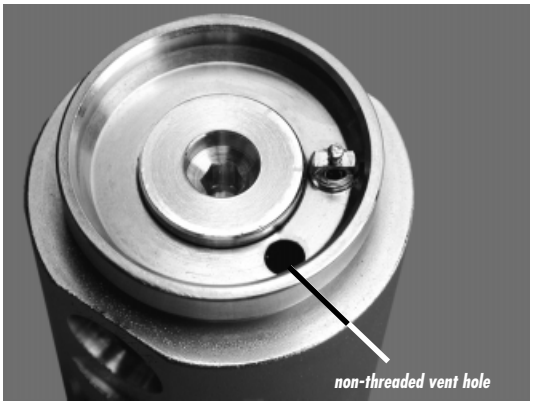


Fig. 16 – Schrader® Valve Installation

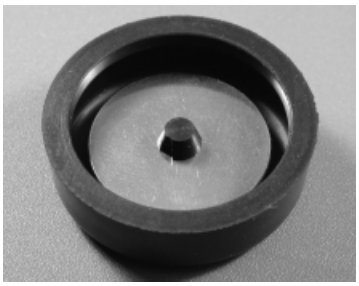


Fig. 17 – Vent Valve Installation



Fig. 18 – Diaphragm Installation



Fig. 19 – HP Seat Installation

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Fig. 20– End Cap Installation



Fig. 21 – Saddle Installation



Fig. 22 – Torquing Yoke Retainer

CAUTION: Unless the spring has been replaced with new, it is very important to reinstall the same number and color combination of spring isolators as the original quantity that was removed during the disassembly procedure. No more than two spring isolators may be used between the spring and the body, and no more than one spring isolator may be used between the spring and the piston.

15. Apply a light film of lubricant to both ends of the spring(27), and place the spring down over the support post inside the high pressure cavity of the body.
16. Place the remaining spring isolator directly over the top of the spring.
17. Hold the body stable with the open end facing straight up, and position the end cap over the body so that the piston shaft is aligned through the center of the spring. Mate the end cap onto the body and firmly press downward while turning it clockwise to engage the threads (see Fig. 20). Continue turning by hand until snug.
18. Wet the inner surface of the saddle(11) with a small amount of water. Then, fit it over the diaphragm and onto the first stage so that the yoke support is centered over the high pressure inlet, and the cap fits snug over the ambient pressure diaphragm (see Fig. 21).
19. Using a vise mounting tool, secure the first stage in a vise with the inlet port and yoke saddle facing straight up.

20. Reassembly of the Yoke Connector

a. Install the O-ring(7) into the yoke retainer(8), followed by the conical filter(6). Closely examine the retaining ring(5) to compare the difference of one side, which is flat, from the other which is rounded. Using snap ring pliers, install the retaining ring into the groove above the filter, with the flat side facing out.

b. Install the smaller main seal O-ring(9) into the groove in the bottom of the yoke retainer, and the larger O-ring(10) onto the shoulder at the base of the threads.

c. Being careful to ensure that the O-rings remain properly seated, insert the threaded end of the yoke retainer through the bottom of the yoke(4), and mate the yoke retainer into the inlet port of the first stage body. Turn the retainer clockwise by hand until snug.

d. Apply a torque wrench with the 1" Yoke Nut Socket (PN 20-155-500) and 3"x⅜" Socket Drive Extension (PN 20-156-50). Tighten the yoke retainer to a torque measurement of 24 foot-lbs (±1). (See Fig. 22.)

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e. Fit the strap of the dust cap(3) over the threads of the yoke screw(2) with the dimple facing up, and mate the yoke screw into the yoke. Turn the screw one to two revolutions clockwise to engage the threads.

21. Reassembly of the DIN Connector

a. Install both O-rings(4e) and filter(4d) into the filter housing(4g).

b. Mate the filter housing into the inlet port of the first stage body, and turn clockwise by hand until snug. Apply a torque wrench with a 13⁄16" deep socket to tighten the filter housing to a torque measurement of 17 foot-lbs (±1). (See Fig. 23.)

c. Fit the handwheel(4f) over the filter housing with the male threaded side facing up.

d. Install both O-rings(4c&4a) onto the filter retainer(4b). Mate the filter retainer into the filter housing, and turn clockwise by hand until snug. Apply a torque wrench with ¼" hex key socket to tighten the filter retainer to a torque measurement of 130 inch-lbs (±10).



Fig. 23 – Torquing DIN Filter Housing

22. Loosen the vise to remove the first stage, and remove the vise mounting tool.

23. Fit the three pin spanner of the First Stage Wrench (PN 30-600-200) over the end cap, and rotate the tool slightly in either direction to engage all three pins with corresponding bore holes. While holding the first stage secure and the tool firmly engaged, turn the end cap clockwise only until it has reached the extent of its thread engagement, and do not tighten beyond snug.

24. Lubricate and install the O-rings(23&33) onto all hoses and port plugs. Install the LP hoses and port plugs(22&34) into their respective ports in the first stage. Apply a calibrated torque wrench with 5⁄32" (4mm) hex key socket (or appropriate size crow foot for hoses) to tighten the port plugs and hoses to a torque measurement of 38 inch-lbs (±2).

▼ *After completing the reassembly of the first stage, proceed to* ***Section 6 – Final Testing***

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SECTION 6

Final Testing Procedures

CAUTION: If the regulator has been upgraded for use with EAN/ Nitrox, it is important to pressurize and flow test the regulator using only hydrocarbon-free gas. The regulator will otherwise become contaminated with hydrocarbons if normal compressed air is used. Industrial grade compressed Nitrogen is strongly recommended as a less expensive alternative to EAN/ Nitrox for the purposes of flow testing.

Intermediate Pressure Test

1. Connect a calibrated intermediate pressure test gauge to the regulator, either with a quick-disconnect inflator hose or with the female fitting of a second stage LP hose, depending on the connection of the test gauge.

CAUTION: To provide a safety relief valve in the event that intermediate pressure exceeds 155-170 psi, ensure that a fully assembled and properly adjusted second stage is connected to the first stage before pressurizing. Failure to relieve intermediate pressure that exceeds 400 psi may result in damage or rupture of the test gauge or LP hose, and could cause serious personal injury.

2. Initially connect the first stage to a supply of 300 psi filtered test gas, and slowly open the supply valve to pressurize the first stage. Closely monitor the IP test gauge to determine whether the intermediate pressure rises above 145 psi.

CAUTION: If the intermediate pressure continues to rise above 200 psi, immediately shut the test gas supply valve. Refer directly to *Table 2 - Troubleshooting*, and remedy as needed before proceeding any further.

3. When the intermediate pressure has been determined to be 145 psi or less, close the supply valve and purge the second stage to depressurize the system. Connect the first stage to a supply of 2,500 - 3,000 psi test gas.

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NOTE: Correct intermediate pressure for the D.A.D. first stage is between 135-145 psi, with a supply pressure of 2,500 - 3000 psi.

4. Open the supply valve again while monitoring the IP test gauge to ensure that the intermediate pressure does not rise above 145 psi. If the intermediate pressure rises above 145 psi, immediately close the supply valve and purge the system. Refer to *Table 2 - Troubleshooting*, and remedy as needed before proceeding.
5. Repeatedly purge the second-stage approximately 15-20 times to cycle the regulator. Then, check the test gauge to determine whether the intermediate pressure locks up consistently after each cycle and remains stable at 140 (±5) psi, with no signs of creeping or fluctuation. If the intermediate pressure is not within the specified range, or if it fails to lock up with no creep, refer to *Table 2 - Troubleshooting* to determine the cause of the problem. Repeat this procedure after the problem is corrected.
6. After determining that the intermediate pressure holds stable at 140 (±5) psi, perform the following tests to further ensure the absence of leaks.

External Leak Test

1. After first stage reassembly and final adjustment of the second stage has been completed, submerge the entire regulator in a test tank of clean water while pressurized with 2,500-3000 psi. Observe any bubbles arising from the submerged regulator over a one minute period. The recommended time is necessary due to slower bubble formation that occurs in smaller leaks. Disassemble the regulator at the source of the leak to check sealing surfaces, assembly sequence and component positioning in order to correct the problem(s).

NOTE: The location of extremely small leaks can best be detected by applying a soap solution to the leak area. Before disassembling to correct any leaks, rinse the entire regulator thoroughly with fresh water and blow out all residual moisture with filtered, low-pressure (25 psi) test gas. Refer to *Table 2 - Troubleshooting.*

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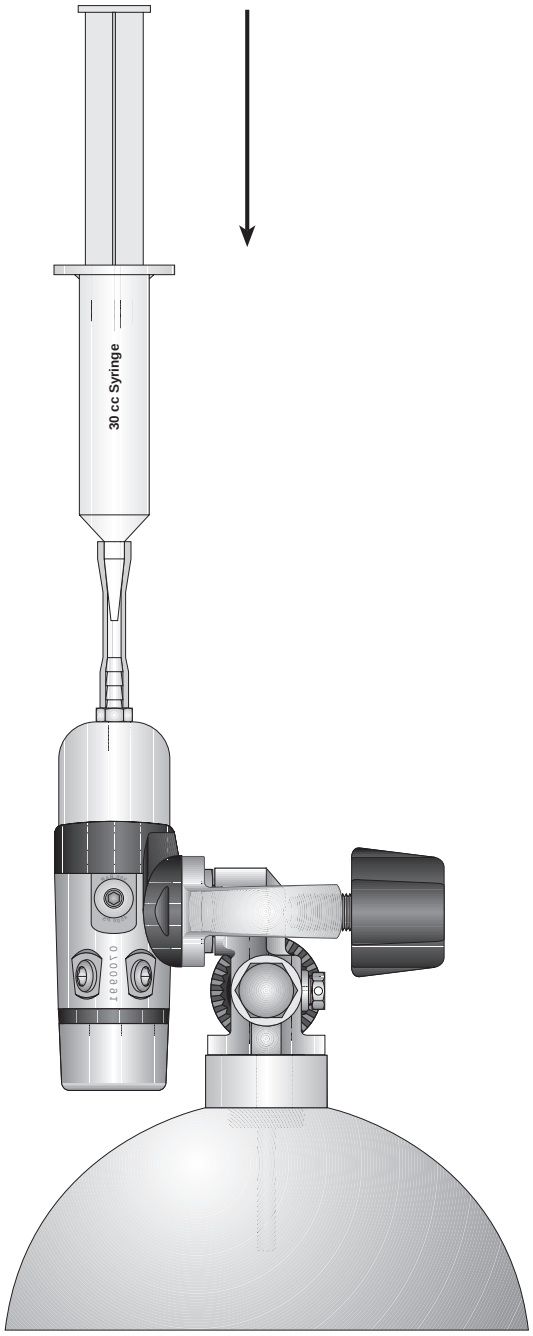


Fig. 24 – Ambient Pressure Valve Test

Ambient Pressure Valve Test

After the first stage exhibits a stable intermediate pressure of 140 (±5) psi with no creep, perform the following test to check the function of the ambient sensing diaphragm and valve, using the D.A.D. Pressure Tool (PN 20-650-400).

1. Mount the first stage on an accessible supply valve, with the high pressure end and plastic saddle facing straight up. Pressurize with 2,500-3000 psi test gas.
2. Examine the Pressure Tool to ensure that the syringe is securely connected to the sealing cup with a short length of flexible tubing, and that the O-ring seal is intact inside the rim of the cup. Retract the plunger fully inside the top of the syringe.
3. Fit the sealing cup of the Pressure Tool over the end of the saddle, and hold it firmly in place to create a seal. While monitoring the IP test gauge, rapidly depress the plunger to create a surge of pressure against the ambient sensing diaphragm, and check the test gauge to verify that the intermediate pressure increases approximately 10-15 psi. (See Fig. 24.)
4. Purge the second stage to cycle the regulator once, and check the test gauge to verify that the intermediate pressure returns to its original lockup pressure, with no creep.
5. Repeat Step 3 several times, if necessary, to verify that the intermediate pressure increases when the Pressure Tool is surged, and returns to normal when the regulator is cycled. If the intermediate pressure does not increase or return to a stable lockup pressure, the Schrader valve and sensing diaphragm are either incorrectly installed, or are not functioning properly. Refer to *Table 2 - Troubleshooting* to determine the cause and the required solution.

NOTE: After completing the overhaul service procedures for the second stage regulator, it is important to test the complete regulator, first and second stage, together as a complete unit, following the final testing procedures outlined in the second stage service guide.

This completes the overhaul service procedures for the D.A.D. First Stage Regulator

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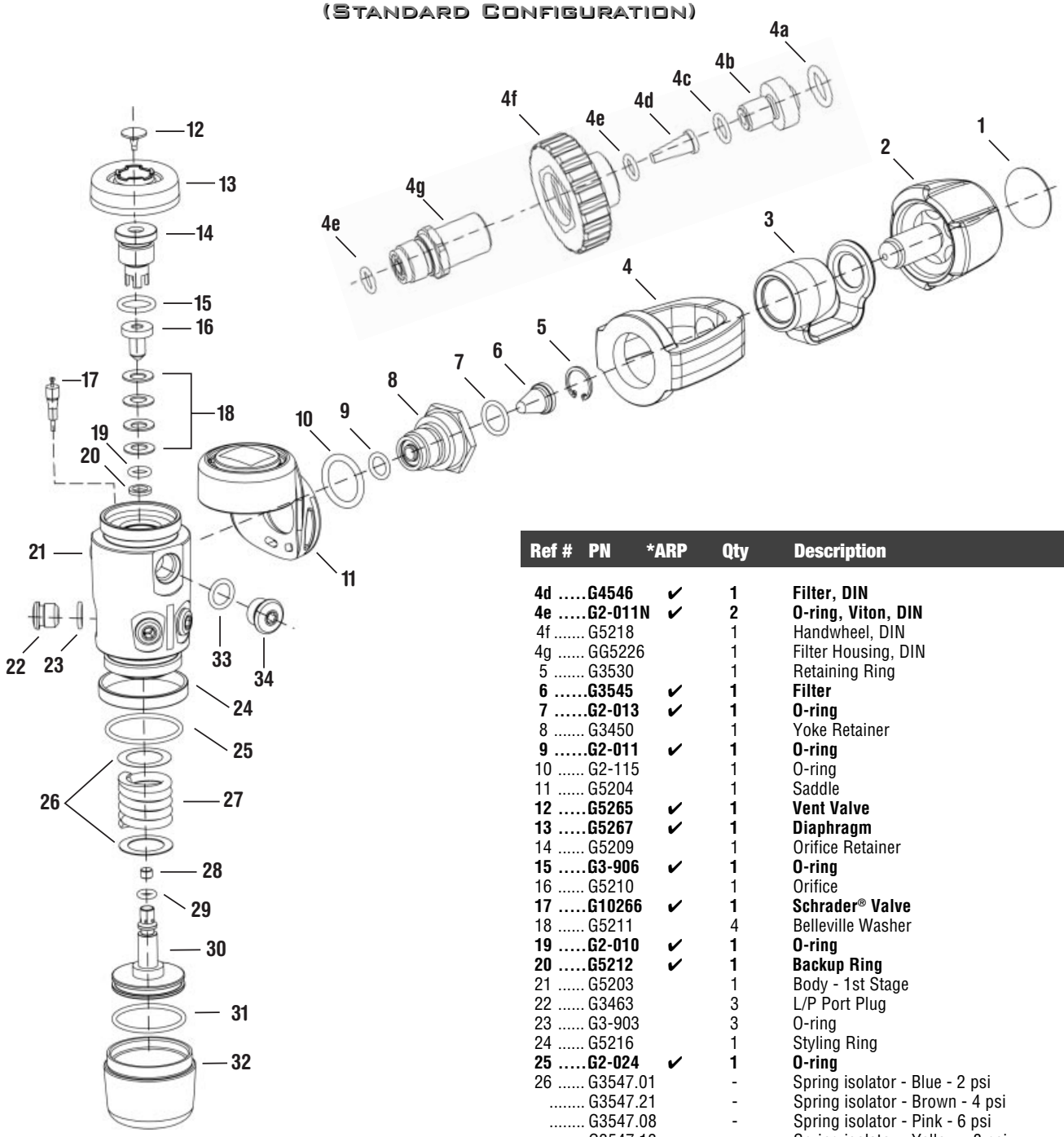
Table 2 – Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Excessive inhalation resistance from both second stages	1. Cylinder valve partially opened.	1. Fully open valve, then turn back 1/4 turn. Check fill pressure.
	2. Cylinder valve requires service.	2. Connect to a different cylinder.
	3. Conical filter(6) is clogged.	3. Replace filter with new.
	4. Low intermediate pressure.	4. See below.
Low intermediate pressure	1. End cap (32) is loose.	1. Tighten end cap until snug.
	2. Belleville washers (18) are assembled incorrectly.	2. Reassemble as shown in Figure 14.
	3. Main valve spring (27) is damaged.	3. Replace spring and spring isolators.
	4. Schrader valve (17) is not functioning correctly.	4. Check condition of ambient diaphragm (13) and Schrader valve, and replace or reinstall as needed. Perform final test procedure.
	5. Incorrect number/ thickness of spring isolators(26) are installed on either side of valve spring.	5. (With new spring only:) Replace one or both spring isolators with higher thickness.
High intermediate pressure	1. HP seat (28) damaged or worn.	1. Replace HP seat.
	2. Piston O-rings (29 or 31) damaged or worn.	2. Replace O-rings.
	3. Orifice (16) is damaged.	3. Replace orifice.
	4. First stage body (21) damaged internally.	4. Replace body.
	5. Incorrect number/ thickness of spring isolators(26) are installed on either side of valve spring.	5. Replace one or both spring isolators with lower thickness.
Leakage from beneath yoke	1. Yoke retainer O-ring (9) damaged or worn.	1. Replace O-ring.
Constant leakage from beneath the the end of the saddle	1. Schrader valve (17) is not functioning correctly.	1. Check condition of ambient diaphragm (13) and Schrader valve, and replace or reinstall as needed. Perform final test procedure.
	2. Vent valve (12) is incorrectly installed or damaged.	2. Reinstall or replace vent valve as needed.
	3. Crown retainer (14) and O-ring (15) are incorrectly installed or damaged.	3. Reinstall or replace as needed.
	4. Excessively high intermediate pressure.	4. Remedy as indicated above.

CAUTION: All repairs must be performed with a complete overhaul service, unless the problem is detected immediately after a complete overhaul service has already been performed. Do not attempt to perform partial service if the regulator shows any signs of use. For additional troubleshooting assistance, contact your Genesis Scuba distributor.

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Schematic & Parts List
D.A.D. First Stage
(Standard Configuration)



Ref #	PN	*ARP	Qty	Description
	PK400		**-**	**Overhaul Service Kit**
	GR400		**-**	**D.A.D. First Stage, Assembled**
1	G5213		1	Decal - Knob
2	G5201		1	Handwheel
3	G5205		1	Dust Cap
4	G6316		1	Yoke
4a	**G6347N**	✔	**1**	**O-ring, Urethane, DIN**
4b	G4544-200		1	Filter Retainer, DIN
4c	**GG2-012N**	✔	**1**	**O-ring, Viton, DIN**

Ref #	PN	*ARP	Qty	Description
4d	**G4546**	✔	**1**	**Filter, DIN**
4e	**G2-011N**	✔	**2**	**O-ring, Viton, DIN**
4f	G5218		1	Handwheel, DIN
4g	GG5226		1	Filter Housing, DIN
5	G3530		1	Retaining Ring
6	**G3545**	✔	**1**	**Filter**
7	**G2-013**	✔	**1**	**O-ring**
8	G3450		1	Yoke Retainer
9	**G2-011**	✔	**1**	**O-ring**
10	G2-115		1	O-ring
11	G5204		1	Saddle
12	**G5265**	✔	**1**	**Vent Valve**
13	**G5267**	✔	**1**	**Diaphragm**
14	G5209		1	Orifice Retainer
15	**G3-906**	✔	**1**	**O-ring**
16	G5210		1	Orifice
17	**G10266**	✔	**1**	**Schrader® Valve**
18	G5211		4	Belleville Washer
19	**G2-010**	✔	**1**	**O-ring**
20	**G5212**	✔	**1**	**Backup Ring**
21	G5203		1	Body - 1st Stage
22	G3463		3	L/P Port Plug
23	G3-903		3	O-ring
24	G5216		1	Styling Ring
25	**G2-024**	✔	**1**	**O-ring**
26	G3547.01		-	Spring isolator - Blue - 2 psi
	G3547.21		-	Spring isolator - Brown - 4 psi
	G3547.08		-	Spring isolator - Pink - 6 psi
	G3547.13		-	Spring isolator - Yellow - 8 psi
	G3547.11		-	Spring isolator - White - 10 psi
27	G5217		1	H/P Spring
28	**G5269**	✔	**1**	**H/P Seat**
29	**G2-008**	✔	**1**	**O-ring**
30	G5083		1	Piston
31	**G2-023**	✔	**1**	**O-ring**
32	G5202		1	End Cap
33	G3-904		2	O-ring
34	G3462		2	H/P Port Plug

** ARP indicates Automatic Replacement Part - Provided in Overhaul Parts Kit*

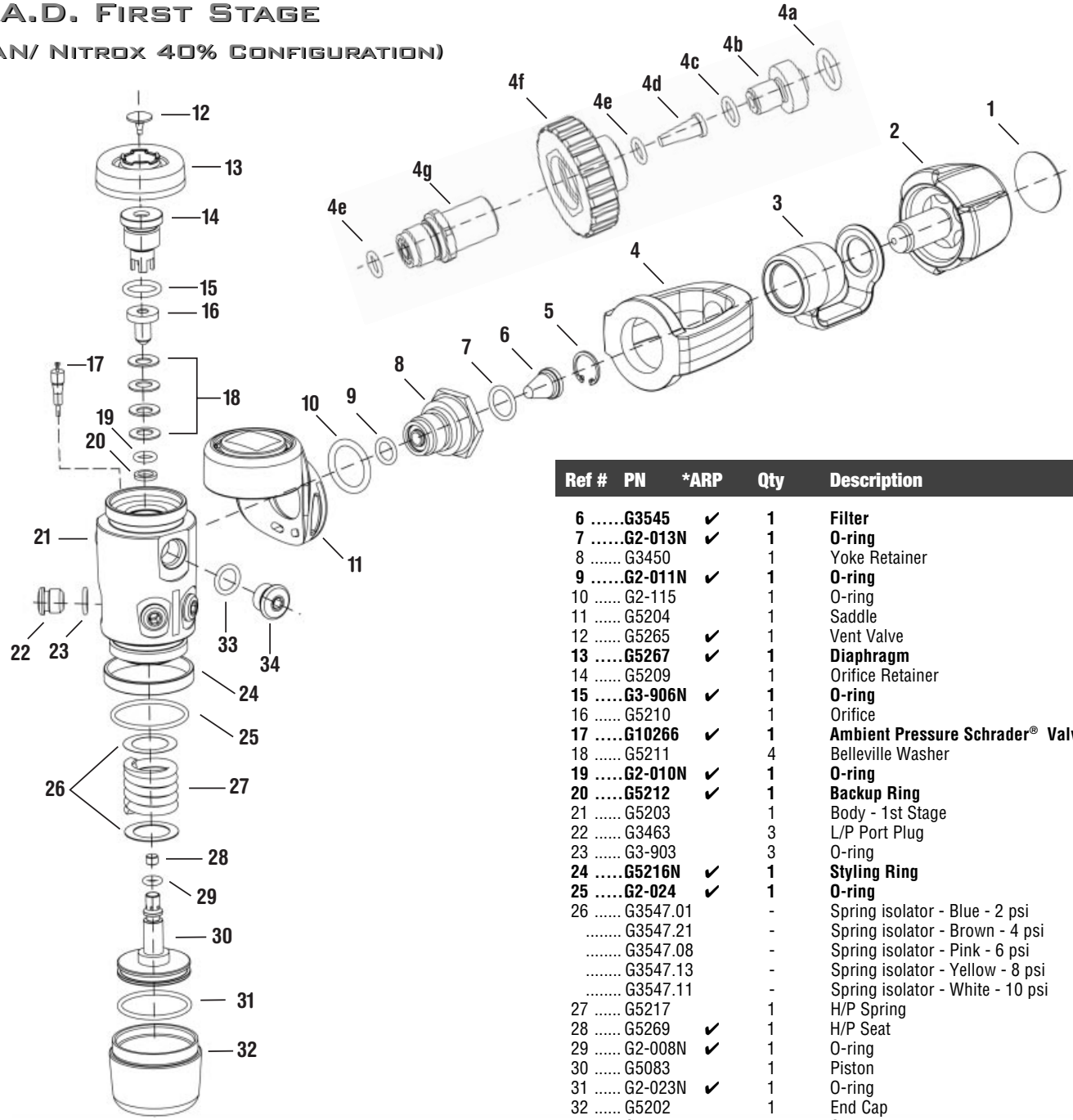
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NOTES

Schematic & Parts List

D.A.D. First Stage

(EAN/ Nitrox 40% Configuration)



Ref #	PN	*ARP	Qty	Description
	PK400N		**-**	**Nitrox Upgrade/ Overhaul Kit**
1	G5213		1	Decal - Knob
2	G5201		1	Handwheel
3	G5205		1	Dust Cap
4	G6316		1	Yoke
4a	**G6347N**	✔	**1**	**O-ring, Urethane, DIN**
4b	G4544-200		1	Filter Retainer, DIN
4c	**GG2-012N**	✔	**1**	**O-ring, Viton, DIN**
4d	**G4546**	✔	**1**	**Filter, DIN**
4e	**G2-011N**	✔	**2**	**O-ring, Viton, DIN**
4f	G5218		1	Handwheel, DIN
4g	GG5226		1	Filter Housing, DIN
5	G3530		1	Retaining Ring
6	**G3545**	✔	**1**	**Filter**
7	**G2-013N**	✔	**1**	**O-ring**
8	G3450		1	Yoke Retainer
9	**G2-011N**	✔	**1**	**O-ring**
10	G2-115		1	O-ring
11	G5204		1	Saddle
12	G5265	✔	1	Vent Valve
13	**G5267**	✔	**1**	**Diaphragm**
14	G5209		1	Orifice Retainer
15	**G3-906N**	✔	**1**	**O-ring**
16	G5210		1	Orifice
17	**G10266**	✔	**1**	**Ambient Pressure Schrader® Valve**
18	G5211		4	Belleville Washer
19	**G2-010N**	✔	**1**	**O-ring**
20	**G5212**	✔	**1**	**Backup Ring**
21	G5203		1	Body - 1st Stage
22	G3463		3	L/P Port Plug
23	G3-903		3	O-ring
24	**G5216N**	✔	**1**	**Styling Ring**
25	**G2-024**	✔	**1**	**O-ring**
26	G3547.01		-	Spring isolator - Blue - 2 psi
	G3547.21		-	Spring isolator - Brown - 4 psi
	G3547.08		-	Spring isolator - Pink - 6 psi
	G3547.13		-	Spring isolator - Yellow - 8 psi
	G3547.11		-	Spring isolator - White - 10 psi
27	G5217		1	H/P Spring
28	G5269	✔	1	H/P Seat
29	G2-008N	✔	1	O-ring
30	G5083		1	Piston
31	G2-023N	✔	1	O-ring
32	G5202		1	End Cap
33	G3-904N	✔	2	O-ring
34	G3462		2	H/P Port Plug

** ARP indicates Automatic Replacement Part - Provided in Nitrox/ Upgrade Service Kit*

WARNING: Before installing the Nitrox Upgrade/ Overhaul Parts Kit, the regulator must first be overhauled and cleaned according the EAN/ Nitrox Cleaning Procedure outlined in this manual. It must also be tested only with hydrocarbon-free test gas, and dedicated for use only with professionally blended mixtures of enriched air that do not exceed 40% oxygen content. Failure to heed this warning may result in serious injury or death due to an oxygen fire or explosion.

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