Enriched Air (Nitrox)

Authorized
Aqua-Lung™ Dealer

Cleaning & Service Procedures

Doc. No. 9002-08

Contents

Doc. No. 9002-08

U.S. DIVERS® AQUA-LUNG

Enriched Air Cleaning & Service Procedures

Introduction

This manual provides instructions for the service and cleaning of regulators, cylinders, and cylinder valves which have been approved by U.S. Divers Co., Inc. for dedicated use with enriched air Nitrox (EAN). It does not provide step by step overhaul procedures, however, and must be used in addendum to the inspection, disassembly, and reassembly procedures which are prescribed in the Authorized Service & Repair Manual for each individual product. Before attempting to perform the procedures outlined in this manual, the technician must have a thorough understanding of the product, and have received training for its overhaul service through a factory sponsored service seminar.

WARNING: Possession of this manual does not constitute any consent by U.S. Divers Co., Inc., implied or otherwise, to perform service of U.S. Divers products. Individuals performing the procedures described herein outside of an Authorized U.S. Divers Pro-Line Dealer will automatically assume sole responsibility and all liability for any damage or injuries which may result from improper service.

Warnings, Cautions, & Notes

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

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

A **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.

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

Is Special Service Really Necessary?

When handling oxygen enriched air, it is important to understand the many variable factors which can contribute to an oxygen fire or explosion, in addition to the gas mixture's percentage of oxygen. These include:

- Valve design (frictional heating & adiabatic compression potential)
- Materials compatibility (reactivity to oxygen)
- Contamination of equipment (presence of hydrocarbon and particulate matter)
- Age and degradation of component materials
- Purity of gas
- Inlet pressure
- Flow rate
- Temperature

When enough of these factors have met certain critical conditions, it eventually becomes possible for a fire or explosion to occur—even with normal, atmospheric air which contains only 21% oxygen. Whatever fire hazard that exists with any specific system will always become greater, however, as the percentage or partial pressure of oxygen is increased.

It is therefore not reasonable to declare that *all* gas delivery systems may generally be considered safe for use with one mixture, such as thirty-nine or forty percent, but may become unsafe when the mixture is increased by one percent or more. Compatibility may vary from one system to another as other factors are introduced, and there is no data available to prove exactly at which mixture enriched air poses a significant fire hazard, greater than that of atmospheric air. In the case of scuba equipment, these factors become even more varied and complex, due to the fact that regulators and cylinders are handled independently of each other, allowing little control over the entire breathing system.

The most sensible and prudent approach to preparing equipment for enriched air use is to reduce the possible risk of each factor to a reasonable minimum. This can be achieved by doing the following:

- Use only equipment (regulator, cylinder, and pressure gauge) that is dedicated for Nitrox, and rated compatible by the manufacturer.
- Obtain EAN fills only from a competent blending facility that can provide hydrocarbon-free enriched air, without exposing the equipment to elevated concentrations of oxygen above 40%.
- Strictly avoid any use of Nitrox equipment with normal compressed air.
- Obtain factory prescribed overhaul service on a scheduled basis, which includes the cleaning and service procedures outlined in this manual.

Enriched air cleaning and service does not need to pose an unreasonable expense to the consumer. If performed properly, the procedures prescribed in this manual will provide the professional dive store with the most practical methods possible, which can be provided at a reasonable cost. While there are more extensive and complex procedures which are prescribed for equipment used with pure oxygen in other industries, these procedures are extremely effective for cleaning scuba equipment that is dedicated for use with enriched air.

WARNING: U.S. Divers products are not intended for contact or use with pure oxygen under any circumstances. All procedures prescribed in this manual assume the use of pre-mixed, hydrocarbon-free enriched air containing no more than 40% oxygen.

Compatibility Requirements

Before servicing a specific piece of equipment that will subsequently be declared compatible for use with enriched air, it must first be determined whether the equipment is properly designed and manufactured for this purpose. There are two essential requirements which must be met by any high pressure valve (cylinder or regulator first-stage) that is to be used with oxygen enriched air:

First, the valve must be designed for use with high concentrations of oxygen, or its design must be studied by the manufacturer and determined to be compatible or modified as needed. Certain valve designs contain gas flow patterns which can cause frictional heating of the gas. These designs should be avoided.

Second, the valve must contain only materials which are either non-reactive to oxygen, or have sufficiently high ignition temperatures to minimize the possibility of burning in an oxygen environment.

It must therefore not be assumed that any given regulator or cylinder valve can be converted to enriched air use simply by performing the cleaning and service procedures outlined in this manual. Instead, these procedures are intended exclusively for those regulators and valves which have been tested and approved for enriched air use by U.S. Divers Co., Inc. Please refer to the current U.S. Divers product catalog for a complete list of EAN approved products, or contact a Technical Services Representative for more information.

What is Enriched Air Cleaning?

Scuba technicians are already familiar with the procedures prescribed by most manufacturers for cleaning component parts during the course of an annual overhaul service, which commonly requires the use of an acid bath and an ultrasonic cleaner. While these procedures are generally very effective for removing scale and surface corrosion, however, they are not adequate for completely removing various contaminants which may provide an ignition source for an oxygen fire. An additional cleaning procedure, referred to throughout this text as *Enriched Air Cleaning*, must be employed to remove the following common sources of contamination:

- Silicone Grease
- Machining oils and thread lubricants
- Certain cleaning solvents and detergents
- Paint, ink, and marking wax
- Burrs and metal particles
- Chrome flakes or scars
- Rust and other oxidized metals
- Carbon dust
- Airborne dust and soot
- Skin oil
- Pipe thread sealants (Teflon tape)
- Soap or detergent residue
- Cloth lint
- Compressor oil

Some of these contaminants may be introduced during the initial assembly of products intended for use with atmospheric breathing air, for which they normally pose no hazard. Other contaminants may be introduced during subsequent use and overhaul service procedures prescribed for normal air. Food grade silicone grease, for example, is commonly used as a lubricant and O-ring dressing in normal breathing air systems, but becomes reactive when exposed to elevated partial pressures of oxygen. It must therefore be completely removed and replaced with a lubricant that is rated compatible with oxygen. (Refer to Table B - Recommended Cleaners & Lubricants.)

A common source of hydrocarbon contamination is compressor oil, which passes through most compressor systems that produce normal, Grade E breathing air. Normal filtration does not completely remove all traces of oil, and its residue can easily accumulate inside valves, hoses, and cylinders. Like silicone grease, this hydrocarbon residue does not constitute a fire hazard in a system used with normal breathing air, but it can become extremely reactive with higher concentrations of oxygen. Because the amount of oil residue that is present cannot be measured, the breathing system should be considered contaminated immediately upon its first exposure to normal breathing air from an oil lubricated compressor.

Whenever crossover contamination occurs, the entire system must therefore be overhauled and cleaned before it can again be used with enriched air containing more than 23.5 percent oxygen. This is one reason why it is extremely important to use a dedicated system with enriched air that is certified as hydrocarbon-free, or at least, oxygen compatible, and avoid any crossover use with normal, Grade E breathing air.

It is important to note that some fill stations may use oil-free compressor systems which produce normal breathing air (21% oxygen) that can be certified as *hydrocarbon-free*. Others which use oil lubricated compressors with the addition of special filtration may produce air that contains a minimal, but acceptable level of hydrocarbons, and can be certified as *oxygen compatible*. Dedicated EAN cylinders may be filled with atmospheric air that is certified as either *oxygen compatible* or *hydrocarbon-free* without immediate danger of hydrocarbon contamination.

It is important to make this distinction between *oxygen compatible* and *hydrocarbon-free* air, because the slight amount of condensed hydrocarbons found in air that is *oxygen compatible* may eventually accumulate inside a breathing system to a potentially dangerous level, unless overhaul service and cleaning is performed on a scheduled basis.

Cleaning Methods

Within various industries, there are several methods used for cleaning oxygen equipment; including steam cleaning, caustic cleaning (hot alkaline solution), solvent cleaning—either in a vapor degreaser or ultrasonic cleaner, or ultrasonic immersion in an aqueous (water based) detergent. Criteria for choosing the best one includes the following:

- Type and concentration of contaminants being removed (i.e., heavy grease or wax vs. light oils)
- Type of pre-cleaning method used
- Intended use of the equipment
- Size and geometry of component parts
- Volume of items being cleaned
- Materials compatibility
- Potential hazards to personnel
- Ease of removal
- Ease of disposal

Until recently, the most commonly used procedures for cleaning small component parts of oxygen equipment, borrowed from the medical and aerospace industries, have required the use of CFC (Chlorinated Fluorocarbon) solvents. Due to many environmental hazards associated with the use and disposal of these chemicals, however, they are rapidly becoming unavailable, and their use will eventually be strictly prohibited in the U.S. and many other countries. This has recently created a strong demand for new types of solvents which are specifically formulated for the task of oxygen cleaning, but do not contain ozone depleting CFC's. Although new solvents are currently being developed, however, they still pose other potential health

and environmental hazards, and must be disposed of accordingly. Additionally, these solvents are known to be retained in the pores of aluminum, and should not be used with aluminum cylinders.

As a far better alternative, aqueous (water based) cleaning solutions have also been recently developed which are non-ozone depleting and non-flammable. Many are biodegradable, and can be disposed of much more easily than a solvent. When used in addition to a pre-cleaning acid bath, a properly selected aqueous solution can be extremely effective for the purposes of cleaning EAN equipment.

AQUEOUS CLEANING FOR EAN SERVICE

For the retail dive store, aqueous cleaning provides the most practical, yet effective means of removing the contamination that is typically found in high pressure breathing valves. Depending on the selection of a suitable solution, it is relatively simple to use, non-flammable, safe for personnel, and easy to dispose of. (Refer to Table B- Recommended Cleaners & Lubricants).

Not all aqueous cleaning solutions are equally suited for cleaning enriched air scuba equipment, however. Some contain detergents which are environmentally hazardous and require special handling and disposal. They may also be incompatible with materials other than certain metals, and unsuitable for cleaning soft parts; including seats, O-rings, and gaskets. Others can foam during cleaning, and may leave a residue after numerous rinsings.

It is therefore important to select an aqueous cleaning solution which is completely non-toxic and biodegradable, and can be safely disposed of by emptying into a sewer system that is connected to a waste treatment facility. It must also be non-carcinogenic and reasonably safe for incidental contact with skin and eyes. It should not foam excessively when agitated, and it should easily rinse clean without leaving any residue. Refer to Table B-Recommended Cleaners & Lubricants, for a list of the cleaning solutions which U.S. Divers has currently approved. It is important to dilute the aqueous cleaning solution only with distilled or demineralized water, according to the ratio specified by the manufacturer.

CAUTION: It is important to carefully read and understand the Material Safety Data Sheet for any cleaning solution before using it.

Most aqueous cleaning solutions may be reused at least more than once, but will eventually require replacement as more contaminants and particulate matter are held in suspension. Following each cleaning, it is important to 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. It is also advisable to maintain a log to record the amount of use one batch of solution receives, and not rely solely on its appearance. Whenever in doubt, dispose of the solution and replace with fresh.

It is important to note that aqueous cleaning alone will not remove corrosion and scale from component parts of regulators, cylinder valves, and hose assemblies, which must first be thoroughly cleaned with an acid bath. Enriched Air Cleaning of these items is therefore a three-stage process, which requires *Pre-Cleaning*; performing the steps outlined in Procedure A, prior to *Aqueous Cleaning*; outlined in the procedures provided in this manual.

CAUTION: Interior surfaces of cylinders do not require the same pre-cleaning procedures as valve components. Do not attempt to pre-clean a cylinder using any type of acid or chemical solvent.

Rinsing, the final stage in the cleaning procedure, is arguably more crucial than the actual cleaning. 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 the complete removal of cleaning solution, and dry immediately afterward, using only low pressure (50-150 psi), hydrocarbon-free gas (Nitrogen or EAN).

> **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 work, this is a less expensive alternative to distilled water.

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 which consists of three gradual steps.

Direct Light Inspection—This inspection is used to detect the most obvious contamination on accessible surfaces, which may be visible with or without strong magnification, beneath strong incandescent or fluorescent lighting.

Ultraviolet Light—Contamination which is present, but not visible beneath fluorescent light, will often fluoresce or glow beneath ultraviolet light. This is not always reliable, however, for certain compressor oils.

Wipe Test—This serves either as a final inspection after the part has passed inspection under both fluorescent light and ultraviolet light, or it may be used to inspect surfaces which are non-accessible for direct viewing, such as the interior of a cylinder. To perform this inspection, rub the surface lightly with a lint free wipe, and view the wipe beneath strong fluorescent or incandescent light, and then ultraviolet light to check for any signs of contamination.

PREPARING THE WORKSTATION

Enriched air cleaning procedures may be carried out in the same work area which 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 disposable protective barrier, such as butcher paper or plastic sheeting. The technician must wear clean, non-powdered latex or plastic gloves whenever handling cleaned parts. All tools and fixtures, including the ultrasonic cleaner tank and cylinder visual inspection light, must be kept completely clean of any contaminants. For this reason, a separate set of clean tools must be used for the reassembly of enriched air equipment, different from those used for normal air equipment.

It is especially important to use two separate ultrasonic cleaners—one to contain the pre-cleaner acid bath, and the other to contain the aqueous cleaning solution. Likewise, separate containers must be used for rinsing. It is otherwise likely that clean parts will be recontaminated if these precautions are not taken.

For a complete list of all tools needed, refer to Table 2 - Recommended Tool List in each respective Service & Repair Manual, in addition to those listed in Table 1 of this manual.

Lubricants for Enriched Air

Perhaps the most critical component of any high pressure valve or pressure gauge used with enriched air is the lubricant grease. Conventional silicone grease (Dow 111) is considered to be unacceptable for use in any enriched air system, due to its reactivity to oxygen. Aside from the risk of oxygen fire, silicone will quickly oxidize and break down when exposed to high pressure enriched air, and will eventually fail to provide adequate lubricity. This may impair the regulator's performance.

Prior to reassembly, it is therefore necessary to use an approved grease that is non-reactive with oxygen, yet provides at least the same lubricity as silicone. At this writing, Christo-Lube® is the only lubricant recommended by U.S. Divers for use with enriched air. It provides superior lubricity even to that of silicone grease, and it is completely inert. (See Table B - Recommended Lubricants & Cleaners for EAN Use.)

EAN Spare Parts

All mandatory replacement parts must be obtained directly from U.S. Divers, packaged in sealed kits specifically for use in EAN dedicated regulators. These kits include O-rings, seats, and washers made of materials which are proven compatible with EAN

at the partial pressures they will be exposed to, and have been specially cleaned to ensure the absence of contaminants. It is therefore 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. (Refer to schematics provided for the Aquarius and SEA regulators, and the cylinder Z-Valve.)

Before installing, it is also necessary to handle the parts in these kits with care, wearing rubber or plastic gloves to prevent contamination.

WARNING: Use only genuine factory parts purchased directly from U.S. Divers when servicing U.S. Divers EAN equipment. Substitution with any part purchased from a different source other than U.S. Divers constitutes an after market modification of the product, and renders all warranties null and void. The use of substitute parts may also render the product non-compatible with enriched air, and could result in an oxygen fire or explosion, which could lead to serious injury or death.

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.

Labeling & Packaging

After performing the enriched air cleaning and service procedures outlined in this manual, it is extremely important to ensure that each piece of equipment serviced is clearly labeled and identified for dedicated use with EAN. This will help to prevent any crossover use with atmospheric air, and will also help to prevent any unintentional use by untrained users.

Regulators must be assembled with the appropriate second stage box tops, first-stage yoke screws, dust caps, and hose protectors. Ensure that the dust cap is tightly sealed over the first-stage inlet, and seal the regulator inside an airtight plastic bag.

NOTE: Non-EAN model Aquarius and SEA4 regulators may be upgraded for EAN provided that they are retrofitted with EAN box tops, yoke screws, and hose protectors, available as separate kits. (Refer to Spare Parts Catalog.)

Cylinders must be assembled only with the EAN Z-Valve, capped to prevent the entrance of dust, and must bear a clearly legible label provided by U.S. Divers stating the intended use of the cylinder. Additionally, the Gas Analysis Tag must be completely filled out to record the mixture and pressure of the gas inside the cylinder.

Before proceeding to the enriched air cleaning procedures on the following page, refer to Tables A and B to determine which tools and supplies will be needed, and closely review each procedure prior to beginning any overhaul service.

Cleaning Procedures

REGULATORS & CYLINDER VALVE

NOTE: Although low pressure (second-stage) components do not require the same care and treatment as high pressure (first-stage & cylinder valve), U.S. Divers recommends that the same cleaning and assembly procedures be followed for the first and second stage, using the same lubricant and specialty parts provided in kit form for enriched air use. This prevents the possibility of cross contamination, and guarantees the integrity of the complete system. Do not attempt to service the first-stage independent of the second stage, but rather service the entire regulator at the same time.

1. After completing the disassembly procedure outlined in the Service & Repair Manual, lay out all parts for identification. Set aside all mandatory replacement parts, including O-rings, seats, filters, and gaskets to be discarded after showing to the customer. Ensure that a complete kit of new parts is available.
2. Remove both O-rings from the low pressure hose, and set the hose aside.
3. Wipe clean all reusable parts which have any visible residue of grease, and closely inspect to ensure that there are no visible signs of chrome loss or damage, including scratches, nicks, burrs, etc. Do not attempt to reuse any part which is damaged.
4. It is essential to pre-clean all reusable parts in an acid bath according to Procedure A. This must be done first before proceeding to the enriched air cleaning procedures. Amendments to Procedure A, provided in previous Authorized Service & Repair Manuals, are as follows:
   a. For the acid bath, use only ChromeSafe™ cleaning solution, which contains an additional degreasing agent.
   b. Use of an ultrasonic cleaner is an essential requirement—during both pre-cleaning and aqueous cleaning.
   c. A neutralizing bath is not necessary, as all residue of the acid bath will be removed during aqueous cleaning.
   c. Use only distilled or de-mineralized water for all dilution of the acid bath and all rinsing. Water drawn straight from the tap is not acceptable.
   d. Disregard all lubrication instructions which refer to the use of silicone grease.
5. When all parts have been thoroughly cleaned and rinsed with de-mineralized water, it is important to inspect them to ensure that all corrosion has been removed prior to proceeding to the next step. Also, inspect closely once again to ensure that there are no signs of chrome loss or other damage which have become visible during the cleaning, and do not attempt to reuse any part which is found to be damaged.
6. 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 B for a list of approved solutions, and follow the manufacturer's instructions for dilution rates and recommended working temperatures.) It is important that the solution is fresh, and is not saturated with contaminants removed during prior cleanings. If in doubt, empty the ultrasonic cleaner and wipe clean with a lint-free cloth before refilling with fresh solution.

⚠ **NOTE:** It is often difficult to discern whether the solution has become saturated with contaminants to the extent which requires replacement. It is therefore recommended that a log be kept to record the amount of usage it has received, as a guideline for its replacement.

7. Once the parts have been immersed in the aqueous cleaning solution, 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. If a glove does become contaminated, it can be cleaned with isopropyl alcohol.

⚠ **CAUTION:** Do not attempt to perform the following steps without first donning powderless latex gloves. Without this barrier present, parts are certain to become contaminated with skin oil.

8. 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 geometries 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.
9. Transfer the parts, via the dip basket, into a suitably clean container of fresh de-mineralized water, heated to 140-160º F to facilitate faster drying. Agitate the parts lightly to ensure thorough rinsing, and to completely remove any residue of the aqueous cleaning solution. Parts with more complex geometries will require additional attention to ensure complete rinsing of threads, crevices, and recesses.
10. Remove the parts individually from the fresh water rinse, and blow dry with low pressure (50 psi), hydrocarbon-free gas, such as nitrogen or hydrocarbon-free air. Set aside on a clean, lint-free surface covered with butcher paper or cellophane.
11. 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, chrome loss, burrs, filings, grease, fingerprints, oil, grease, or other contamination. Repeat the above cleaning procedure or replace the part as needed.
12. 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.

13. 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 possible contamination.

14. 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. Do not use parts which appear to be in questionable condition.

WARNING: Do not attempt to use individually ordered spare parts as a substitute for those packaged in kit form by U.S. Divers for servicing enriched air equipment. Doing so will render the product incompatible for use with enriched air, and may jeopardize the safety of the diver.

15. 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.
16. Prior to reassembly, lightly dress all O-rings only with Christo-Lube® grease, being careful to prevent the grease from becoming contaminated in the process. Set the O-rings aside on a perfectly clean surface that is covered with cellophane. Do not use grease which appears to be contaminated with any particulate matter or other foreign debris.

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

17. Using only tools which have been specially cleaned and dedicated for enriched air service, reassemble the first and second stages according to the procedures prescribed in their respective Authorized Service & Repair Manuals.

NOTE: During reassembly, it may be necessary to clean the gloves occasionally, using isopropyl alcohol, or replace them with new if they become visibly contaminated.

CAUTION: U.S. Divers enriched air regulators are not intended for cold water use, and must not be modified with the Supreme environmental protection kit. Doing so may allow the entrance of silicone fluid, which is non-compatible with EAN.

HIGH PRESSURE HOSE ASSEMBLY & DATAPRO-EAN PRESSURE GAUGE

1. While holding the retaining nut secure at the base of the 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 heavy deposits.
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 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 ChromeSafe™ 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.
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 which drains from the hose contains no residue of the aqueous cleaning solution (i.e., no foam, scent, or color).
18. Shake off excessive moisture, and wipe all surfaces of the hose fittings with a clean, lint free wipe. Inspect both the wipe and fittings under strong fluorescent or incandescent light to check for any signs of oils, grease, or particulate matter. If found, repeat the aqueous cleaning procedure.
19. Assuming no contamination was found, immediately inspect the wipes and fittings 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.

20. Dress the hose O-ring with clean Christo-Lube® grease, and install the 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® grease. 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.
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 ready for reassembly onto the first stage.

LOW PRESSURE HOSE ASSEMBLIES

1. Ultrasonically clean both hose fittings by dipping only the hose ends in the ChromeSafe™ acid bath, and rinse thoroughly in distilled or demineralized 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. When the hose fittings have been cleaned, rinse them repeatedly by swishing in demineralized or distilled water.
4. 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, performing this step again if a new hose is needed.
5. 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.

6. Ultrasonically clean both fittings inside and out with aqueous cleaner, using a soft nylon brush and lint-free swabs to clean all surfaces, including threads, crevices, and recesses.
7. Thoroughly rinse the hose inside and out with heated, demineralized water, to completely remove all traces of aqueous cleaning solution.
8. Direct hydrocarbon-free gas through the hose until it is completely dry inside and out.
9. Wipe all surfaces of both hose fittings clean with lint free wipes and swabs, and inspect with the use of a magnifier under strong artificial light to check for any signs of contamination remaining. Repeat the aqueous cleaning procedure or replace the part as needed.
10. Inspect wipes and fittings under ultraviolet light for signs of oils, grease, or 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.

11. Dress the hose O-rings with clean Christo-Lube® grease, and install the O-rings onto their respective fittings.

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.

12. Set the hose aside on clean surface, and wrap both fittings with cellophane until ready for reassembly onto first and second stages.
13. When reassembly of both the first and second stage has been completed, assemble all hoses with the torque values prescribed in the Service & Repair Manual.
14. Remove and discard gloves. Do not attempt to reuse.
15. Using only hydrocarbon-free gas, perform the first-stage Final Tuning & Testing Procedures prescribed in the Authorized Service & Repair Manuals, setting the first-stage intermediate pressure first, and then tuning the second stage.

CAUTION: Do not connect the regulator to any cylinder or air supply which 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 23.5 percent oxygen until the above cleaning procedure has been repeated.

CYLINDERS

1. First, visually inspect the cylinder as required for normal air use, to ensure that it contains no cracking, severe pitting, sediment, or residue of fluids, rust, aluminum hydroxide, etc. Tumble and pre-clean as needed to achieve a consistently clean surface throughout the interior of the cylinder.

CAUTION: The use of any acid or chemical solvent must be strictly avoided during the pre-cleaning process, as these may leave residue which cannot be reliably removed from even a mildly pitted surface.

NOTE: For complete instructions on cylinder inspection, cleaning and tumbling, refer to Inspecting Cylinders, written by William L. High, available from Watersport Publishing.

CAUTION: Do not attempt to use any cylinder for enriched air use which is not found to be in acceptable condition to meet all visual inspection requirements.

2. Assuming the cylinder has passed visual inspection according to PSI (Professional Scuba Inspectors) requirements, and is within hydrostatic test requirements, proceed to clean the cylinder for enriched air use as follows:
3. Using a lint-free cloth, wipe the female threads inside the cylinder neck thoroughly, in order to remove any grease or loose metal particles.

NOTE: If the cylinder has not been previously dedicated for enriched air use, it will be necessary to take additional steps to remove any silicone grease which has accumulated in and around the threaded neck area.

4. Apply a small amount of aqueous cleaner (diluted and heated per manufacturer's instructions) to the cylinder threads, and scrub inside surface of threads and surrounding neck area thoroughly, using a pre-cleaned 1-inch nylon bottle brush.
5. Fill the cylinder at least 1/3 full with aqueous cleaning solution (diluted and heated per manufacturer's instructions), and seal the neck. Tumble the cylinder for 10-20 minutes.
6. After tumbling the cylinder, insert a nylon cable brush into the cylinder and thoroughly scrub all surfaces inside before draining.

NOTE: A stainless steel wire brush may be used for steel cylinders, but will cause serious damage to aluminum. Use only nylon brushes for aluminum cylinders.

7. Drain the cleaning solution from the cylinder into a clean container, in order to reuse the solution if it appears to be in reusable condition, with no visible signs of suspended particles or other contamination.
8. Rinse out the cylinder several times with clean, potable water,

until no trace of the aqueous cleaning solution is present.

9. Immediately fill the cylinder at least 1/3 full with heated distilled or demineralized water. Reseal the neck, and tumble the cylinder for 5-10 minutes.
10. Empty the cylinder, and fill once again at least 1/3 full with fresh, hot demineralized water. Tumble the cylinder again for 5-10 minutes.
11. Empty the cylinder, and examine the water to ensure that no suspended particles can be seen and no foam is present. Also, check to ensure that no trace of the aqueous cleaning solution can be detected by smell. Repeat the above rinsing procedure if necessary, until the rinse water pours out clean, with no signs of contaminants or traces of the cleaning solution.
12. Turn the cylinder upside down on a drying rack and inject low pressure (140 psi) hydrocarbon-free gas to blow it completely dry inside.

CAUTION: Take the necessary precautions to ensure that the drying rack is perfectly clean and free of any contaminants, in order to prevent recontamination of the cylinder. Do not use standard compressed air.

13. 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.

CAUTION: Do not attempt to perform the following steps without first donning powderless latex gloves. Without this barrier present, parts are certain to become contaminated with skin oil, regardless of how clean the hands are.

14. Using an inspection light which is cleaned and dedicated for enriched air cylinder inspections, visually inspect the cylinder to ensure that it is completely dry inside, and contains no signs of moisture, residue, or loose matter.

CAUTION: Do not attempt to visually inspect the cylinder with the use of a light which is used for air cylinders. Doing so will contaminate the enriched air cylinder, requiring the cleaning procedure outlined above to be repeated.

NOTE: While it is possible to fabricate an ultraviolet cylinder inspection light, it will provide only slight additional benefit, due to the fact that many compressor oils do not fluoresce.

15. Cap or seal the cylinder until it is assembled with the valve.

WARNING: U.S. Divers EAN cylinders are intended only for use with the EAN Z-Valve (P/N 0542-51). Do not attempt to install a non-authorized valve onto any U.S. Divers cylinder which has been cleaned, labeled, and dedicated for enriched air use.

16. Before assembling the valve onto the cylinder, dress the valve neck O-ring provided in the valve overhaul parts replacement kit only with Christo-Lube® grease. Install the O-ring onto the valve, taking care to avoid rolling the O-ring across the threads.
17. To prevent galling, apply an even coating of Christo-Lube® grease to the entire thread surface. Slowly thread the valve into the cylinder until hand snug, taking care to prevent cross threading or other thread damage.
18. Apply a 36mm open-end wrench to the flats at the base of the valve, and tighten the valve clockwise lightly snug onto the cylinder, only as far as is required to compress the O-ring.
19. Fill the cylinder with at least 50 psi of hydrocarbon-free enriched air, not exceeding 40% oxygen content.

WARNING: U.S. Divers does not recommend or condone partial pressure blending of air with pure oxygen. Filling the cylinder with any amount of pure oxygen will render all warranties for the cylinder and valve null and void, and may result in serious injury or death.

20. Analyze the gas inside the cylinder with a calibrated analyzer, and record all required information on the contents tag.
21. Ensure that the cylinder is properly labeled and identified as being dedicated for enriched air use, and explain to the customer the importance of filling the cylinder only with tested, hydrocarbon-free enriched air.

This concludes the Enriched Air Cleaning procedures for Regulators, Hoses, SPG, Cylinder Valve, and Cylinder

Glossary

Adiabatic Compression—Movement of gas at high velocity into a closed path or chamber, resulting in sudden generation of heat.

Air—Refers to Grade E (or better) atmospheric air, consisting of 21-23% oxygen and 77-79% nitrogen.

Aqueous Cleaning Solution—Water based liquid, containing detergents which dissolve or emulsify hydrocarbon contaminants.

CFC—Chlorinated Fluorocarbon (ozone depleting).

Contaminant—Any substance, including a hydrocarbon or particulate matter, which provides the fuel for fire ignition.

Demineralized Water—Water which has passed through a filtration system to eliminate or reduce mineral content.

Distilled Water—Water which has been evaporated and collected from condensation, to guarantee the removal of all minerals and impurities.

Enriched Air—Refers to man-made mixtures of air containing more than 23.5% oxygen.

Hydrocarbon-free gas—Refers to air or pure nitrogen which has been produced by a non oil lubricated compressor, and contains zero trace of condensed hydrocarbons.

MSDS—Material Safety Data Sheet.

Oxygen Clean—Refers to a total absence of contaminants which may react with oxygen.

Oxygen Compatible—Refers to a product that has been specially designed and cleaned to minimize the risk of fire in the presence of oxygen.

Oxygen Compatible Air—Compressed air that has either been made with a non oil lubricated compressor, or has passed through special filtration which reduces the level of condensed hydrocarbons to a maximum of 0.1 mg/ M^3. (Includes Hydrocarbon-free Air.) This term does not pertain to the concentration of oxygen.

Pre-Cleaning—Refers to acid bath cleaning which is required for the removal of corrosion and scale prior to performing final, aqueous cleaning.

Table 1
Recommended Tool List

DESCRIPTION	SOURCE	APPLICATION
Ultrasonic cleaner (2)	Branson, Global Mftg.	Acid bath & aqueous cleaning
Lint-free cloth wipes	Medical Supply	Drying & wipe test
Unpowdered latex gloves	Medical Supply	Handling of cleaned parts
Unwaxed butcher paper	Grocer	Workstation preparation
Ultraviolet light	Electrical Supply	Direct & wipe test inspection
Cylinder Inspection Light	PSI, Global Mftg.	Cylinder Inspection
Cylinder Tumbler	PSI, Global Mftg.	Cylinder cleaning
Cylinder Drying Rack	PSI, Global Mftg.	Cylinder drying
Hydrocarbon-free gas	Industrial Gas Supply	Drying & flow testing
Magnifier	Hardware, Medical Supply	Inspection

NOTE: This is only a partial list of the tools required, and does not include all specialty tools required for overhaul service. Refer to the list of tools provided in the Service & Repair Manual for each product, and maintain a separate set of these in clean condition for the purpose of enriched air service.

Procedure A
Pre-Cleaning
(Enriched Air Regulators)

U.S. Divers exclusively recommends ChromeSafe™ regulator cleaner (P/N 0201-09) for pre-cleaning all reusable brass and stainless steel parts of breathing valves used with enriched air. ChromeSafe™ is a specially formulated cleaner that does not harm rubber or Teflon parts, yet effectively removes silicone grease, grime, corrosion, and scale from metal parts.

Before cleaning, closely examine each part to determine its condition. Parts with damage to the chrome finish must be replaced with new, in order to prevent the entrance of chrome particles into the breathing system. Also, examine the geometry of each part to determine whether it contains any recesses or crevices in which contamination or cleaner residue may become trapped. If found, handle the part accordingly during the cleaning and rinsing process, to ensure that all surfaces, internal and external, are flushed with solution, and that no residue remains after rinsing and drying.

⚠ **CAUTION:** Parts with delicate seating surfaces, such as orifice cones, must be isolated and protected from contact with other parts, in order to prevent damage to the sealing surface.

⚠ **NOTE**: Although ChromeSafe™ contains a degreasing agent, cleaning heavily greased parts in ChromeSafe™ will shorten the effective life of the solution, and require it to be replaced on a more frequent basis. Heavily greased parts may be degreased in a solution of warm water and mild dish soap prior to being placed in the acid bath.

1. **ACID BATH** - ChromeSafe™ may be used in pure form, or diluted with up to 7 parts distilled or demineralized water. Soak parts in an ultrasonic cleaner for 3 to 15 minutes, depending on the strength of the solution.

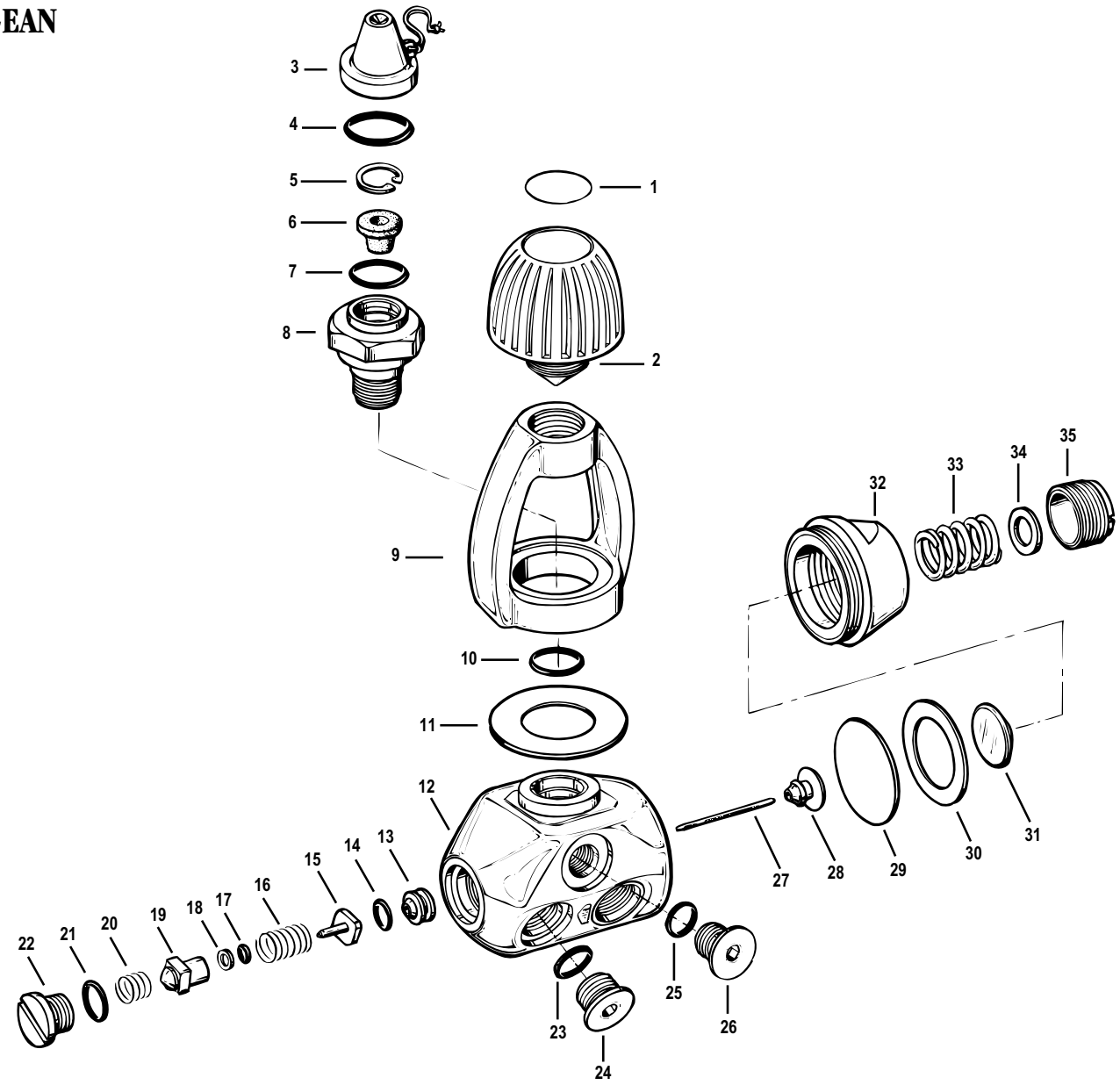
⚠ **CAUTION**: Ultrasonic cleaning times in excess of 15 minutes may damage the chrome finish of certain parts. Be certain to use a timer, and do not leave parts unattended while cleaning.

2. **FRESH WATER RINSE** - Distilled or demineralized water, contained in a perfectly clean container, must be used in order to prevent any mineral residue. Remove parts from the acid bath and place directly into this rinse. Agitate lightly, and allow to soak for at least 15 minutes. Remove and inspect closely to ensure that all corrosion, scale, and grime has been removed before transferring the parts to the aqueous cleaner.

Table B
Recommended Lubricants & Cleaners
(Enriched Air Regulators)

LUBRICANT / CLEANER	APPLICATION	SOURCE
Christo-Lube®	All O-rings; cylinder valve threads	Lubrication Technologies 310 Morton Street Jackson, OH 45640 (614) 286-2644
WARNING: Enriched Air Regulators, Cylinders, & Cylinder Valves must not be lubricated or otherwise brought in contact with any type or grade of silicone grease or oil. Silicone reacts adversely to oxygen, and increases the risk of oxygen fire or explosion.		
ChromeSafe™ (ultrasonic cleaning solution)	Pre-cleaning acid bath for reuseable stainless steel and brass parts.	U.S. Divers P/N 0201-09
Liquid dishwashing detergent (diluted with warm water)	Pre-cleaning degreaser for brass and stainless steel parts, general cleaning solution for plastic, rubber, and anodized aluminum parts.	"Household" grade
Blue Gold Industrial Cleaner	Aqueous enriched air cleaning for all regulator and valve parts, as well as hoses & cylinders.	Modern Chemical P.O. Box 368 Jacksonville, AK 72076 (501) 988-1311
Snoop™	External leak testing	Nupro Company 400 E. 345th St. Willoughby, OH 44094 216-951-7100
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.		

Schematic – First Stage
SEA-EAN

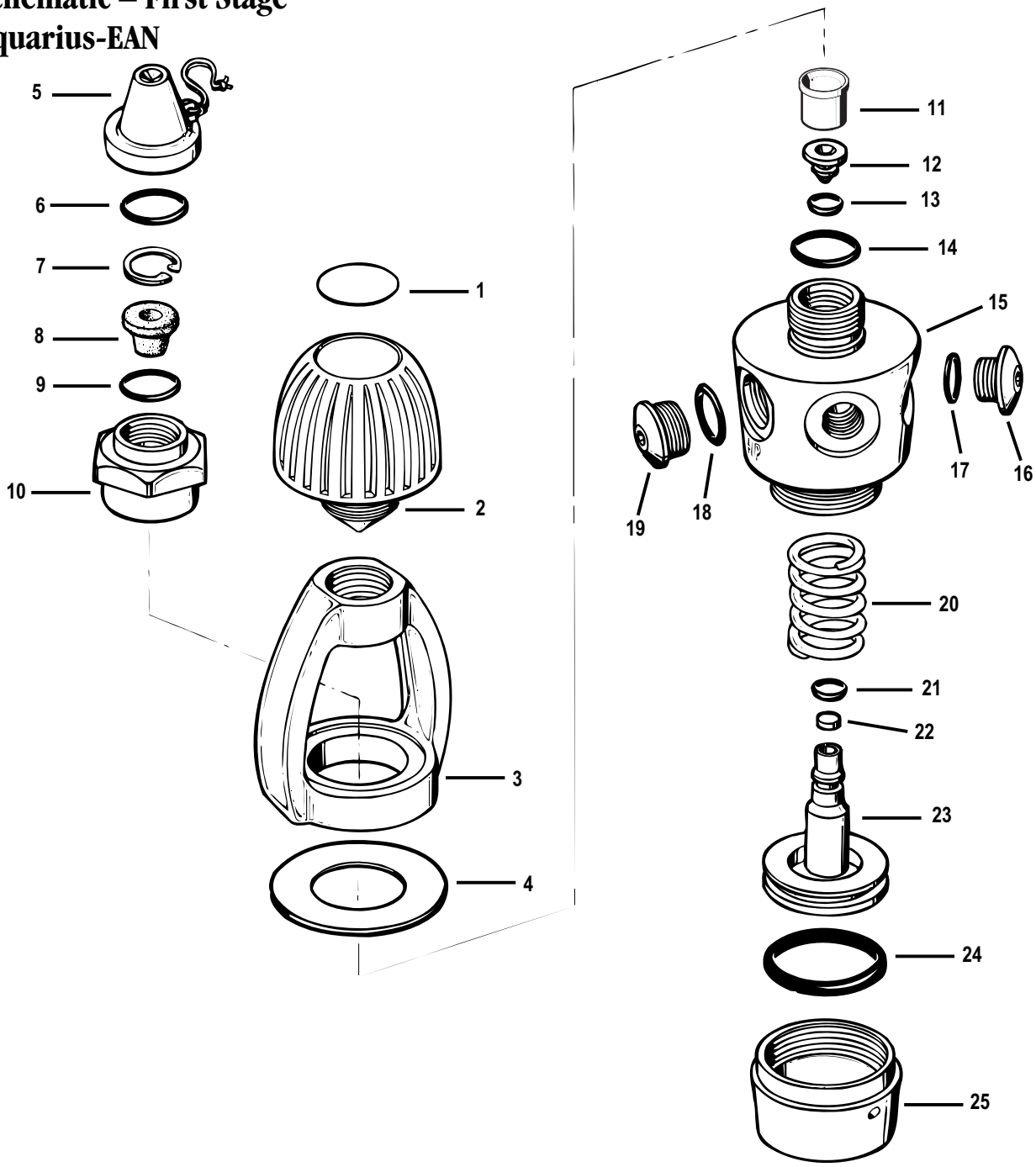


Key #	Part #	Description
-----	9002-06	Overhaul Parts Kit
-----	9002-07	EAN Conversion Kit, SEA First Stage
1	1063-94	Decal
2	1075-06	Yoke Screw
3	1073-28	Dust Cap
4	***8200-49***	***O-ring (EAN)***
5	8630-51	Circlip
6	***1068-29***	***Filter, Conical***
7	***8200-53***	***O-ring (EAN)***
8	1063-39	Inlet Fitting
9	1073-11	Yoke
10	***8200-57***	***O-ring (EAN)***
11	1073-24	Color Ring, EAN
12	1063-22	Body
13	1060-27	Crown
14	***8200-56***	***O-ring (EAN)***
15	***1059-40***	***HP Seat***
16	1015-04	Spring
17	***8200-06***	***O-ring (EAN)***
18	***8280-05***	***Back-up Ring***

Key #	Part #	Description
19	1015-65	Spring Block
20	1046-13	Spring
21	***8200-52***	***O-ring (EAN)***
22	1063-25	Plug
23	***8200-55***	***O-ring (EAN)***
24	1063-03	Port Plug, High Pressure
25	***8200-54***	***O-ring (EAN)***
26	1063-04	Port Plug, Low Pressure
27	1063-23	Pin
28	1060-22	Pin Support
29	***1034-29***	***Diaphragm***
30	***8210-26***	***Thrust Washer***
31	1017-28	Spring Pad
32	1063-24	Spring Retainer
33	1063-56	Main Spring
34	8450-97	Washer, Main Spring
35	1060-23	Adjustment Screw

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

Schematic – First Stage
Aquarius-EAN

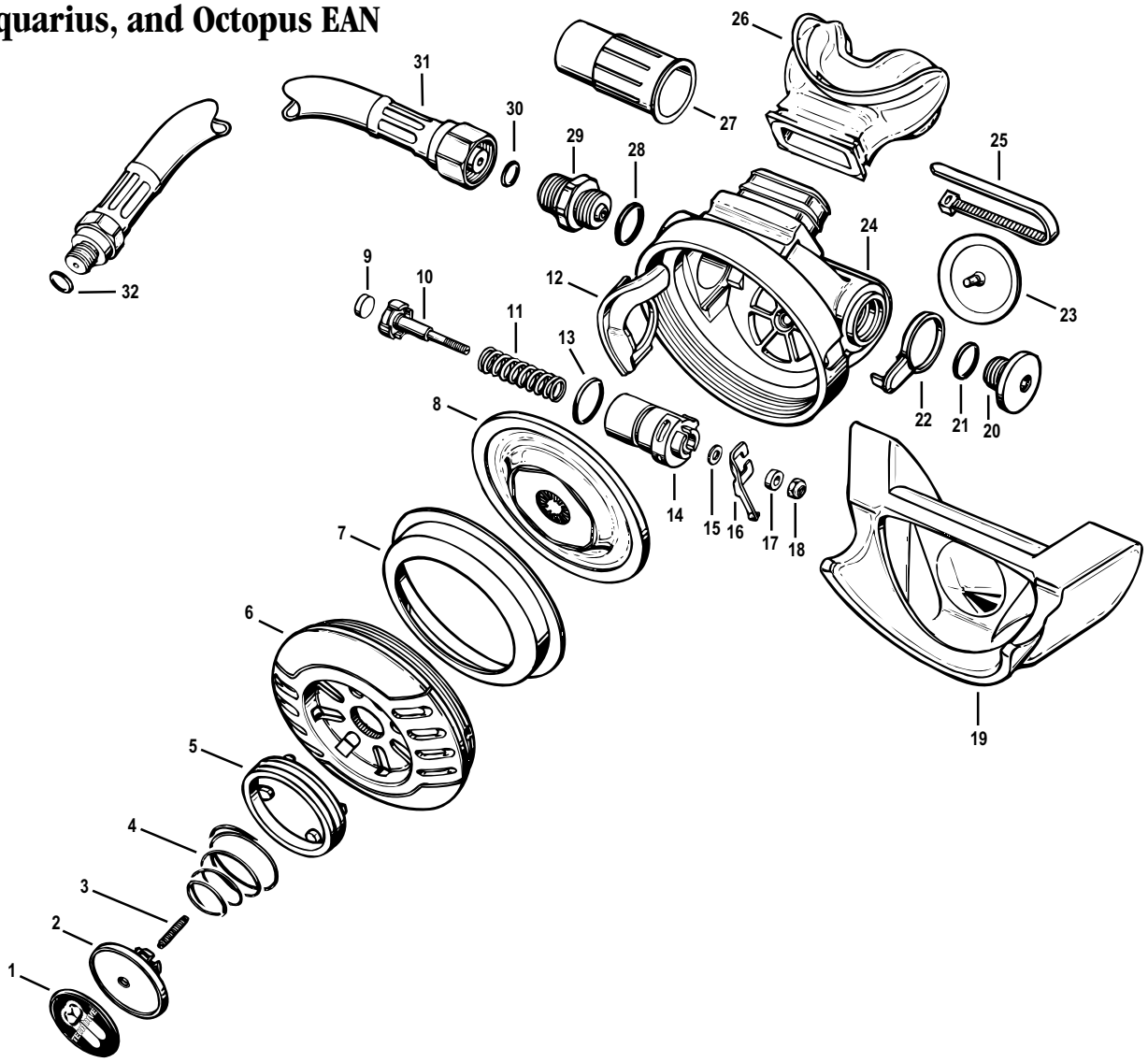


Key #	Part #	Description
-----	9002-04	Overhaul Parts Kit
-----	9002-05	EAN Conversion Kit, Aquarius First Stage
1 -----	1063-94	Decal
2 -----	1075-06	Yoke Screw
3 -----	1073-11	Yoke
4 -----	1073-24	Color Ring, EAN
5 -----	1073-28	Dust Cap
6 ----- 8200-49		***O-ring (EAN)***
7 -----	8630-51	Circlip
8 ----- 1068-29		***Conical Filter***
9 ----- 8200-53		***O-ring (EAN)***
10 ----	1067-36	Yoke Retainer
11 ----	1073-08	Crown Retainer
12 ----	1067-67	Crown
13 ---- 8200-58		***O-ring (EAN)***

Key #	Part #	Description
14 ---- 8200-59		***O-ring (EAN)***
15 ----	1073-01	Body
16 ----	1043-04	LP Port Plug
17 ---- 8200-54		***O-ring (EAN)***
18 ---- 8200-55		***O-ring (EAN)***
19 ----	1020-03	HP Port Plug
20 ----	1067-71	Spring
21 ---- 8200-58		***O-ring (EAN)***
22 ---- 1067-26		***HP Seat***
23 ----	1067-69	Piston
24 ---- 8200-62		***O-ring (EAN)***
25 ----	1073-13	Piston Cap

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

Schematic – Second Stage
SEA, Aquarius, and Octopus EAN

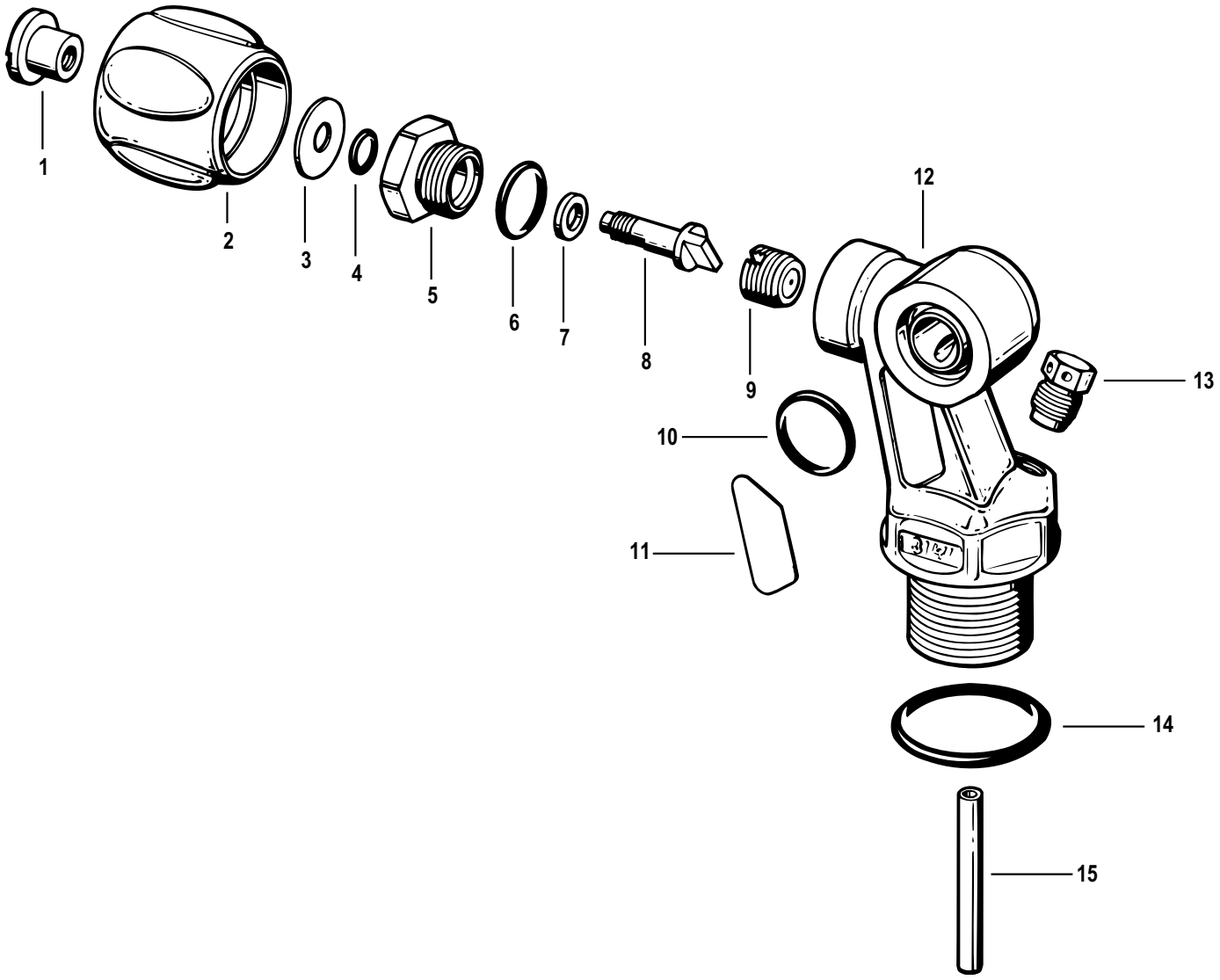


Key #	Part #	Description
-----	9002-02	Overhaul Parts Kit
-----	9002-03	EAN Conversion Kit - Conshelf 2nd Stage
1	----- 1063-84	Purge Button Decal, SEA EAN
-----	1073-84	Purge Button Decal, Aquarius EAN
-----	1003-96	Purge Button Decal, Octo EAN
2	----- 1003-45	Purge Button
3	----- 8307-03	Adjustment Screw
4	----- 1014-36	Purge Spring
5	----- 1073-22	Color Ring, Green (EAN)
6	----- 1003-05	Boxtop, EAN
-----	1073-21	Boxtop, EAN Octopus
7	----- 1003-72	Diaphragm Support Cone
8	----- 1005-71	Demand Diaphragm
9	***----- 1085-10***	***LP Seat***
10	---- 1049-03	Poppet
11	---- 1085-15	Spring (Standard)
-----	1085-14	Spring (Octopus)
12	---- 1005-23	Baffle
13	***---- 8200-59***	***O-ring***
14	---- 1005-14	Valve Insert
15	---- 8450-22	Washer
16	---- 1085-13	Lever
17	---- 1025-17	Spacer
18	***---- 1025-10***	***Locknut***

Key #	Part #	Description
19	---- 1004-59	Exhaust Tee
20	---- 1003-24	Plug
21	***---- 8200-51***	***O-ring***
22	---- 1003-89	Alignment Key
23	***---- 1005-12***	***Exhaust Valve***
24	---- 1005-03	Box Bottom
25	***---- 1049-13***	***Clamp***
26	---- 1058-38	Mouthpiece, Comfo Bite, Snap-on, Standard
-----	1058-31	Mouthpiece, Blk
27	---- 1004-62	Hose Protector
28	***---- 8200-53***	***O-ring***
29	---- 1004-44	Inlet Fitting
30	***---- 8200-61***	***O-ring***
31	---- 1005-35	Hose, SEA EAN (Cleaned for EAN)
-----	1048-35	Hose, Aquarius EAN (Cleaned for EAN)
-----	1016-39	Hose, EAN Octopus, 39" (Cleaned for EAN)
32	***---- 8200-51***	***O-ring, SEA***
-----	***8200-54***	***O-ring, Aquarius, Octopus***
n/s	--- 1020-43	Hose Protector, Green, 1/2"
n/s	--- 1073-29	Hose Protector, Green, 3/8"

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

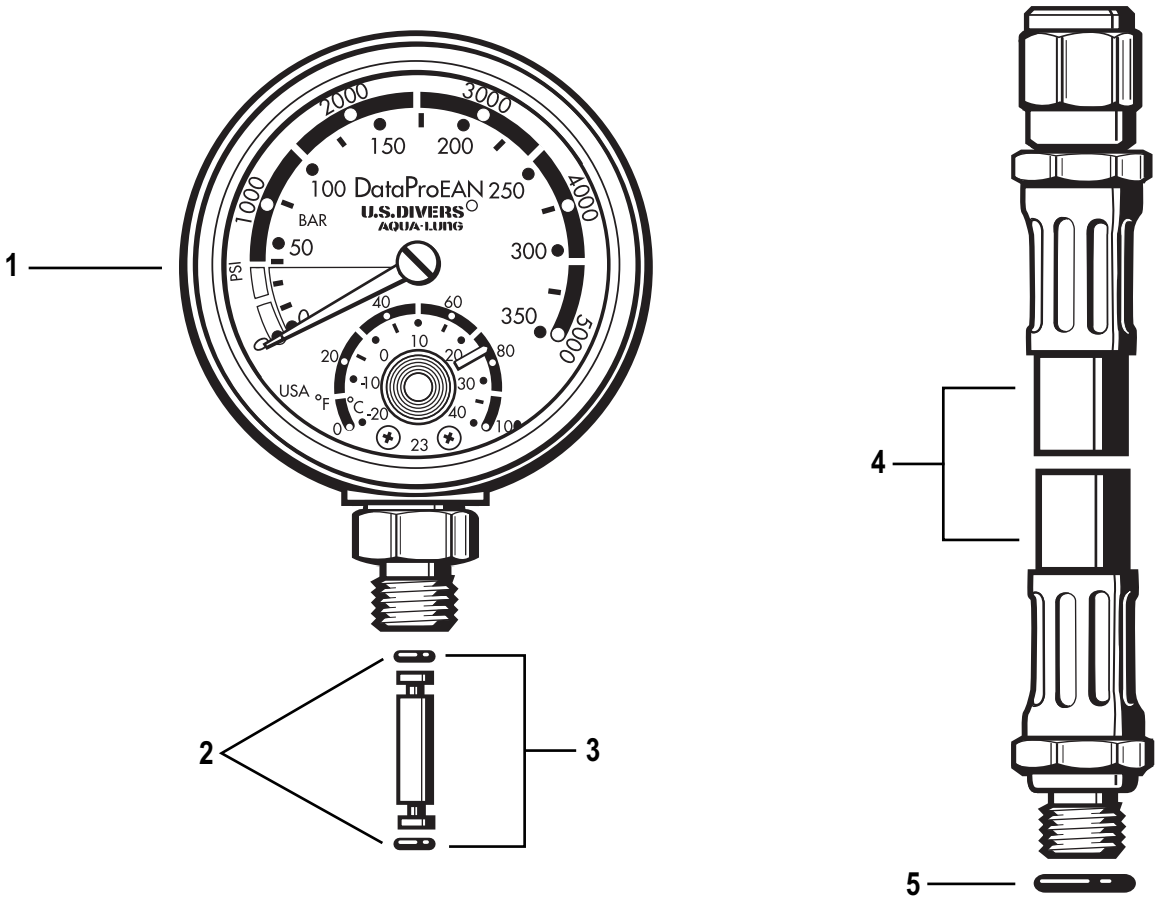
Schematic – Z-Valve EAN



Key #	Part #	Description
-----	0542-51	Z-Valve - 3,000 psi
-----	9002-09	Overhaul Parts Kit
1 -----	0542-66	Nut, Handwheel Retaining
2 -----	0542-64	Handwheel
3 -----	0542-63	Washer
4 -----	***8200-63***	***O-ring (EAN)***
5 -----	0542-59	Bonnet
6 -----	***8200-59***	***O-ring (EAN)***
7 -----	***0542-58***	***Washer, Packing***
8 -----	0542-57	Stem
9 -----	***0542-56***	***Seat***
10 ----	***8200-49***	***O-ring (EAN)***
11 ----	0542-54	Decal
12 ----		Yoke Insert
13 ----	0542-53	Body, Z-Valve
14 ----	***0542-52***	***Burst Disc Assembly***
15 ----	***8200-64***	***O-ring (EAN)***
16 ----	0518-21	Dip Tube
n/s ---	0542-28	Protective Cap, Z-Valve
n/s ---	7500-42	Gas Analysis Tag

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

Schematic – DataPro SPG-EAN



Key #	Part #	Description
	9002-01	Overhaul Parts Kit
1	7542-82	Module Assy
2	***8200-55***	***O-ring (EAN)***
3	7304-85	HP Airspool (w/ O-rings)
4	1020-12	High Pressure Hose (Cleaned for EAN)
5	***8200-93***	***O-ring (EAN)***

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