

Ambi-GASS™

Gas Analysis Sampling System

User Manual



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WARNING

Thank you for purchasing sample gas conditioning equipment from Perma Pure LLC. We want your new sample gas conditioning equipment to operate safely. Anyone who installs or uses this equipment should read this publication before installing or operating this equipment.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed and to verify the equipment, installation and operation is in compliance with the latest revision of these codes.

At a minimum, you should follow all applicable sections of the National Fire Code, National Electrical Code, and the codes of the National Electrical Manufacturer's Association (NEMA). There may be local regulatory or government offices that can also help determine which codes and standards are necessary for safe installation and operation.

Equipment damage or serious personal injury can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your system design, installation or operation. This product should not be operated in any manner that is inconsistent with its intended use.

If you have any questions concerning the installation or operation of this equipment, or you need additional information, please call us at 1-800-337-3762.

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1. Introduction

Perma Pure Ambi-GASS sample pre-conditioning systems are designed to prepare ambient gas sample streams for analysis. The Ambi-GASS system will remove particulate, mists and water vapor without removing the compounds being monitored. Gas conditioning is accomplished by filtering the sample and then removing water vapor with a Nafion membrane gas dryer (see Figure 1).

Standard Features Include:

- Filter – Particulate and/or Coalescing
- Perma Pure Nafion Gas Dryer
- Dryer Purge Flow Controls

Options:

- Sample Pump
- Filter Drain
- Ammonia Scrubber
- Heatless Dryer (Purge Air Dryer)
- Purge Eductor

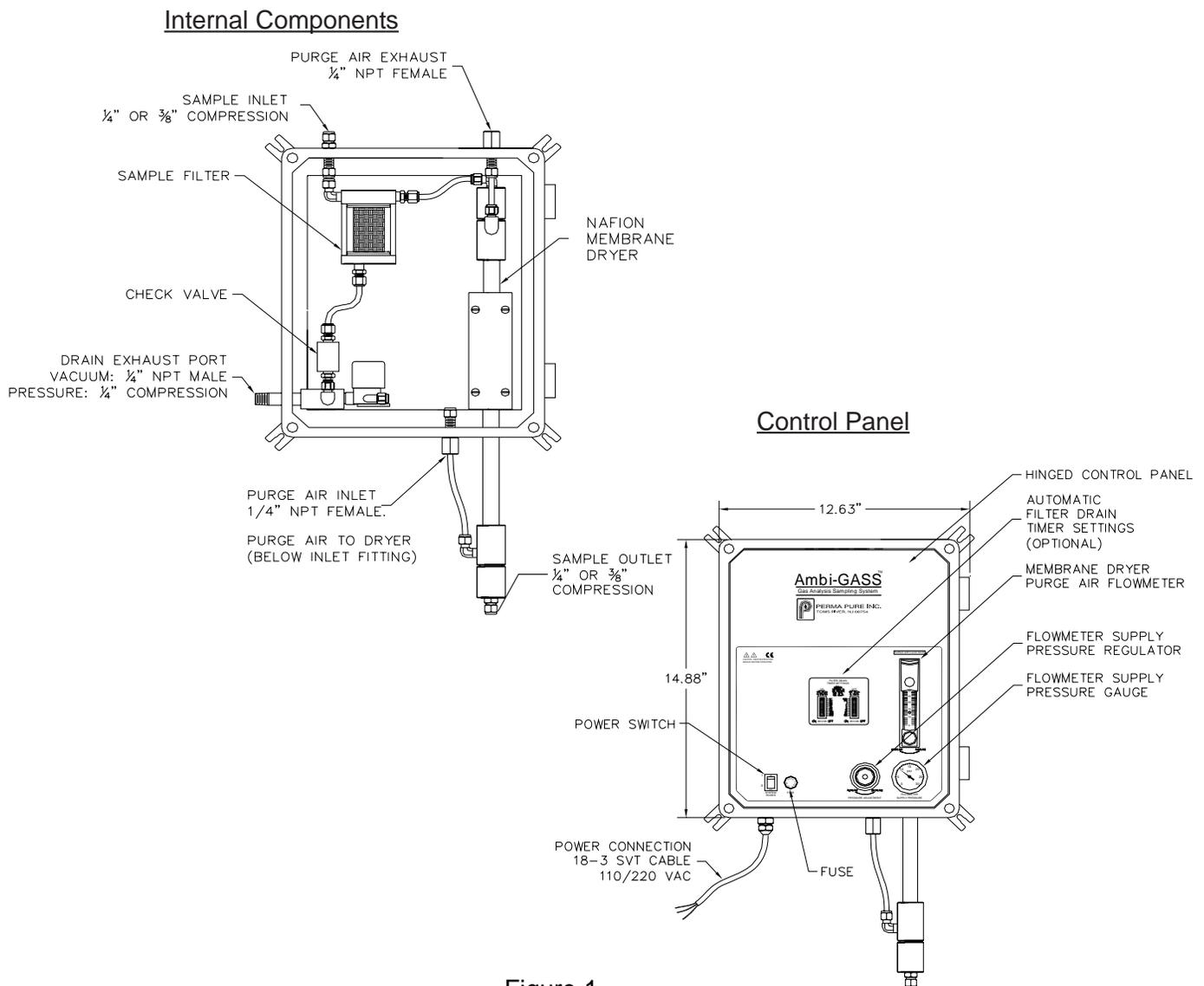


Figure 1

2. Ambi-GASS Components

2.1 Filtration

The first step in conditioning the sample is to filter out particulate and aerosols. This is accomplished by passing the sample through a 1μ filter which has a borosilicate glass filter element with a fluorocarbon binder. The element is disposable. In addition to removing particulate, the filter coalesces liquid

Two flow patterns are possible with this filter:

1. Installed with flow passing from the outside to the inside of the element, the element will act as a particulate filter only. The advantage of this installation is that collected particulate will build up on the outside surface of the element, allowing visual inspection of the element's condition.
2. Installed with the flow passing from the inside of the element to the outside, the element will act as both a particulate and a coalescing filter. Figure 2 details the flow through the filter housing and element.

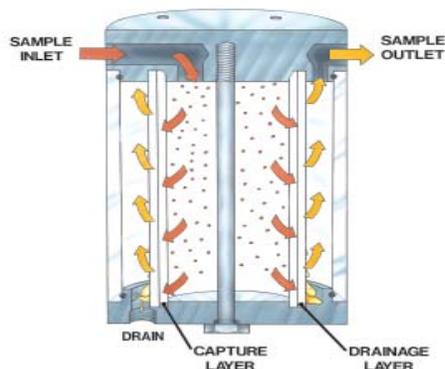


Figure 2

2.2 Automatic Filter Drain (optional)

If coalescing is anticipated, an automatic filter drain is needed in the system to periodically remove collected liquid mists (usually acid mists). The automatic drain will operate in a vacuum or pressurized system.

1. Vacuum Configuration
Collected liquid is withdrawn from the filter drain port by a strong vacuum created by an eductor expanding compressed air through a venturi. This is done in cycles, controlled by an adjustable digital timer that switches a solenoid valve and controlling the compressed air supply.
2. Pressurized Applications
An eductor is not required since a vacuum is not needed to withdraw the sample. Therefore, condensate withdraw is directly controlled by the solenoid valve. Cycle times can be varied and will be dependent on the amount of liquid present in the sample.

2.3 Nafion® Dryer

The Perma Pure Nafion membrane dryer is installed downstream of the filter. As sample enters the dryer, the flow splits into a number of small diameter Nafion membrane tubes arranged in a parallel bundle (see Figure 3 on page 6). After the sample enters one of these tubes it comes in contact with the Nafion membrane walls. The membrane selectively removes water vapor from the sample by a process of permeation distillation. Water vapor travels through the tubing walls driven by the difference in partial water vapor pressure on the opposing sides of the membrane. As the sample flows from inlet to outlet water is continually removed, reducing the sample dew point as it travels through the dryer. Dry purge gas enters the dryer at the sample outlet end and provides a medium for the water vapor from the sample to be carried away.

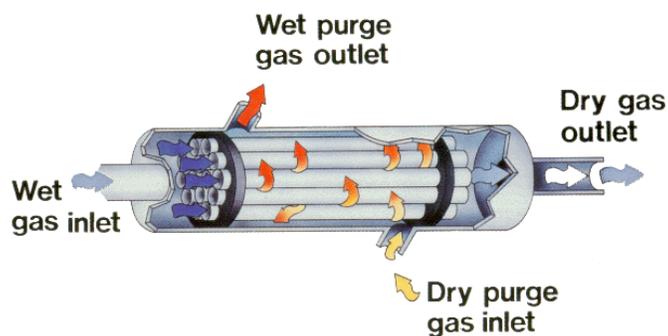


Figure 3

It is important that the dryer removes water in the vapor state only to avoid the problems that arise when the membrane comes in contact with liquid water. If liquid water is introduced into the dryer, efficiency will decline and the dryer could fail to perform altogether. The tubing elongates approximately 10% over its dry length when saturated with liquid water causing the tubing to kink inside the dryer housing, reducing the drying.

2.4 Ammonia Scrubber (optional)

The optional ammonia scrubbing canister must be used when ammonia or urea is used for the purpose of lowering NO_x levels or at any time ammonia is present in the sample stream. Ammonia salts can deposit in the dryer tubes if not removed and cause permanent loss of drying efficiency. The ammonia scrubber consists of a polysulfone and 316 SS housing filled with phosphoric acid impregnated berl saddles. These berl saddles will require periodic replacement at a frequency dependent on the inlet ammonia concentration.

2.5 Purge Air Eductor (optional)

The eductor will provide the desired vacuum inside the dryer shell to compensate for any small vacuum that the sample may be under. This is done to prevent the membrane tubes from collapsing under pressure of the purge air.

2.6 Purge Air Dryer (optional)

If -40°C dewpoint or drier purge air is not available, a heatless air dryer can be installed in the Ambi-GASS to dry a compressed air supply. Operation of the heatless dryer is fully automatic and continuous.

2.7 Sample Pump (optional)

Perma Pure can supply a gas sample pump to draw sample and supply it to the analyzer. The pump supplies up to 5 liters per minute of sample. Typical pump location is **between** the filter and the ammonia scrubber (when installed).

3. Installation

3.1 Mounting

Unit should be shielded from direct rain and snow. Do not install outdoors if temperature will fall below -10°C.

1. Arrange system on a vertical surface.
2. Place mounting feet on each corner of the enclosure with the slotted end protruding at a 45° angle from the enclosure.
3. Drop the mounting screw in from the top and tighten into foot.

3.2 Electrical Connection

Model #	110 VAC	220 VAC
1214	Standard Power Cord and Plug	Cord with Pigtail Wires
1228	Connect power supply line to terminal block located on bottom of control enclosure just inside 1/2" conduit hub. See Figure 4 for color coding.	

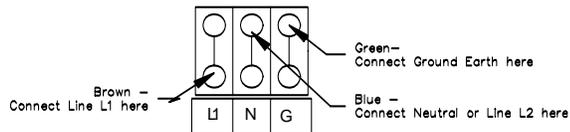


Figure 4

3.3 Plumbing

A. Sample Connection

1. Connect sample line to bulkhead fitting (labeled “Sample Gas In”).
2. Connect sample outlet (labeled “Dry Sample Out”) to sample line going to analyzer.

B. Purge Connection

Instrument Air

- ***The purge air supply must be of instrument grade with a dew point no higher than -40°C .***

1. Connect purge air line to bulkhead fitting (labeled “Instrument Air Inlet”).
2. Set instrument /compressed air supply pressure regulator between 30 and 100 psig.

Heatless Dryer (Optional)

1. Connect purge air line to bulkhead fitting (labeled “Purge Gas Inlet”).
2. Set air pressure regulator between 60 and 100 psig.
3. There will be an additional $\frac{1}{4}$ ” female NPT bulkhead fitting on bottom of enclosure for heatless dryer purge air exhaust (labeled “Heatless Dryer Exhaust”). This will be humid air, and can be vented to atmosphere or piped to a remote location.

C. Purge Eductor Inlet Connection (optional)

Connect air supply line to bulkhead fitting labeled “Compressed Air Inlet”.

D. Filter Drain Connection (optional)

Connect line from eductor outlet to designated collection/exhaust basin containing acid absorption media to prevent release of exhaust to surrounding. $\frac{1}{4}$ ” I.D. tubing can be used for runs up to 10 feet, or larger I.D. tubing for longer exhaust lines. Line should not restrict purge flow.

4. Start-Up Procedure

4.1 Setup Check

1. Check electrical, sample, purge and drain connections have been made.
2. Turn on instrument and/or compressed air to system.

4.2 Purge Air Flow Adjustment

Purge air to dryer is controlled by regulator and flowmeter combination on control panel. Pressure settings are as follows:

1. With optional filter drain – Set pressure to approx. 10 psig.
2. Without filter drain – Set pressure to approx. 20 psig
3. Adjust purge air flow to 1 1/2 to 2 times sample flow.

4.3 Purge Air Eductor (optional)

Adjust eductor regulator until vacuum gauge reads about 2-5 inches of mercury.

Re-adjusted each time changes are made to purge flow rate or purge pressure.

4.4 Automatic Filter Drain (optional)

The automatic filter drain is controlled by a repeat-cycle-timer that operates a solenoid valve. There are two DIP switches located on the timing device that control the drain and cycle times located on backside of control panel.

Factory setting: drain for 0.1 minute once every 24 hours.

Drain time (left DIP switch) 0.1 minutes (1st switch “ON” – all others “OFF”)
to
102.3 minutes (all switches “ON”)

Cycle time (right DIP switch) 1 hours (1st switch “ON” – all others “OFF”)
to
1023 hours (all switches “ON”)

1. Adjust purge air pressure regulator to about 15 psig.

Under Vacuum: Purge air regulator will control air pressure to eductor of the automatic filter drain. The regulator must be set to provide ample vacuum to remove filter condensate but not excessive enough to cause an interruption in sample flow to analyzers.

Under Positive Pressure: Condensate drain flow is directly controlled by a solenoid valve. When solenoid valve is actuated (opened), positive pressure in filter housing purges condensate out of the system through the drain line.

2. Initially adjust DIP switches on the drain timer to drain for 6 seconds every 24 hours. The time on the switches is additive. So, left switch should have only the top 0.1 min. switch in the “ON” position and the right switch should have the 8 and 16 hr. switches in the “ON” position. These time periods may need further adjustment after system has been in operation for a while.

4.5 Sample Flow

Sample may be turned on at this time. Adjust flowmeter to desired flowrate.

5. Maintenance

5.1 Filters

If the system is fitted with a pre-filter, it should be checked regularly to ensure that the element is in good condition. If the element appears to be dirty or begins to cause a flow restriction in the system, it should be replaced.

Filter Element Replacement

1. Loosen bolt on bottom of filter (see Figure 5).
2. Gently pull apart assembly and remove old element.
3. Place new element into grooves in top and bottom of housing.
4. When re-assembling, inspect for o-rings on top and bottom pieces and on center bolt.
5. Install glass shell onto bottom piece
6. Place new element in groove in bottom piece. Be sure that element is seated correctly and parallel to glass shell.
7. Carefully mate bottom assembly onto top piece. Slight twisting motion may be required to allow shell to slip over o-ring seal.
8. Visually make sure element is seated correctly in top groove.
9. Replace bolt through hole in bottom piece and screw clockwise into top piece. Do not to over-tighten center bolt or damage may occur. It should be just tight enough as to not vibrate loose. Over-tightening will not help filter to seal.

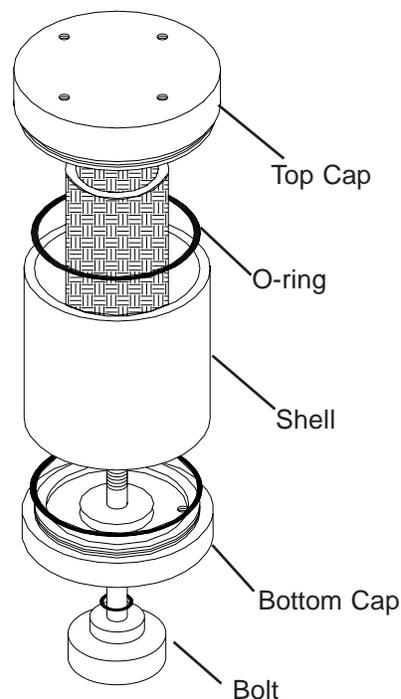


Figure 5

5.2 Dryers

Under normal conditions Perma Pure dryers require little maintenance and can last for several years. However, if there is no pre-filter and tubing becomes clogged or saturated with water, dryer may require cleaning or repair. When disassembling the dryer, note that end fittings on the PD-SERIES dryer can be easily rotated on shell tube. This rotation should be avoided to prevent twisting membrane tubes inside the shell.

Dryer Element Replacement:

1. Take dryer assembly out of unit by unscrewing 4 screws on heater block, 4 screws on bottom of unit along with 2 allen hex head screws.
2. Loosen all compression fittings connecting to dryer.
3. Refer to Appendix B for Dryer Element Replacement.

When connecting any fittings to purge ports of dryer, be sure not to tighten threaded fittings more than 5 turns. Additional turns may cause fitting to damage element header just below.

5.3 Fuse

Fuse Replacement - The fuse is located on or in the control enclosure.

To remove the fuse:

1. Turn cap marked "FUSE" counter-clockwise $\frac{1}{4}$ turn and the fuse holder will come out.
2. Remove blown fuse and replace with one of equal amperage rating. The standard fuse is a BUSS type AGC or equivalent.
3. After installing correct replacement fuse, re-install fuse holder by pressing inward and twisting $\frac{1}{4}$ turn clockwise.

5.4 Ammonia Scrubber

Media Replacement:

When deposits are visible 75% of the way up the length of the scrubber, scrubbing media needs to be replaced.

1. Unscrew thumbscrew on bottom of housing (see Figure 6).
2. Swing yoke to one side.
3. Separate housing and bottom cap as an assembly from top cap.
4. Remove spring and top screen.
5. Remove old media and dispose of properly (housing may be rinsed with soapy water to clean).
6. Fill housing with 50cc of Berl Saddles (tap housing to allow material to settle).
7. Pour 150cc of Scrubbing Media (tap housing to allow material to settle).
8. Replace stainless steel screen on top of media.
9. Replace spring on top of screen.
10. Clean o-rings on shell and inside top manifold (replace if necessary).
11. Place center tube into o-ring seal in top cap.
12. Push and twist to seal housing around o-ring.
13. Replace yoke and tighten thumbscrew finger tight (**do not overtighten doing so may cause housing to crack and cause leakage**).

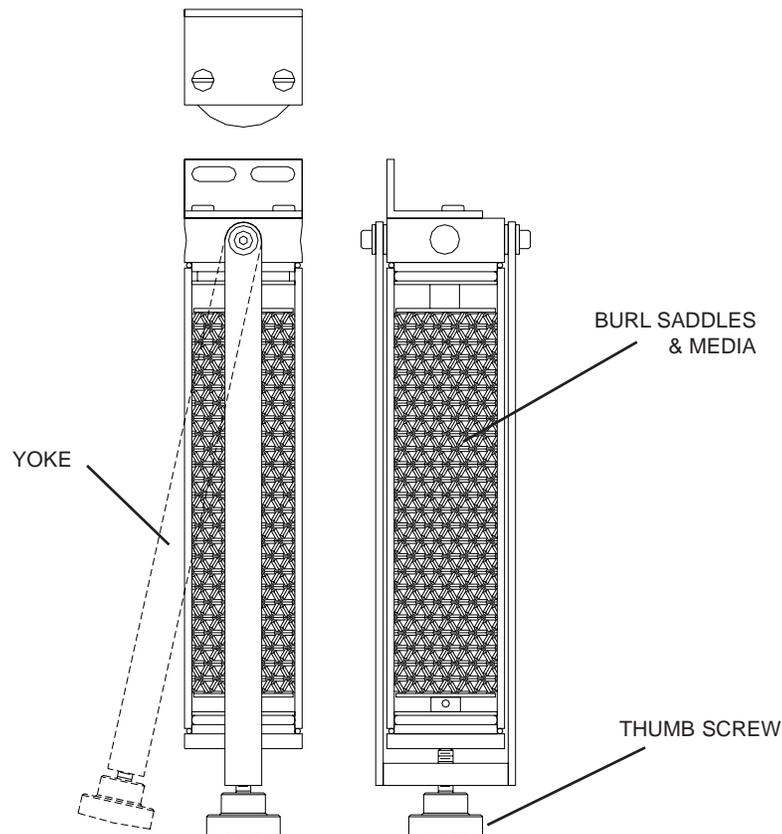


Figure 6

APPENDIX A - Specifications

MAXIMUM SAMPLE FLOW RATE:	0 TO 20 LITERS/MIN
MAXIMUM GAS SAMPLE WATER VAPOR CONTENT:	NON CONDENSING AT AMBIENT TEMPERATURE
SOLUBLE GAS REMOVAL RATES:	NO, NO2 0% loss SO2 0% loss CO, CO2 0% loss H2S, HCl 0% loss
MAXIMUM GAS SAMPLE INLET PRESSURE:	80 PSIG
MINIMUM GAS SAMPLE INLET PRESSURE:	5" H2O VACUUM
GAS SAMPLE INLET FITTINGS:	1/4" or 3/8" TUBING FITTINGS
GAS SAMPLE OUTLET FITTINGS:	1/4" or 3/8" TUBING FITTINGS
AIR REQUIREMENTS:	PURGE AIR -40°C DEW POINT MAXIMUM ONE (1) CFM
ELECTRICAL REQUIREMENTS: - for units with automatic drain	10 WATTS
FUSE:	0.5 AMP BUSS TYPE AGC OR EQUIVALENT
ENCLOSURE:	NEMA 4X, FIBERGLASS WITH POLYCARBONATE COVER
DIMENSIONS:	26" HIGH X 11" WIDE X 8" DEEP
OPERATING ENVIRONMENT:	-20°C TO 40°C AMBIENT TEMP. 0 TO 95% R.H.

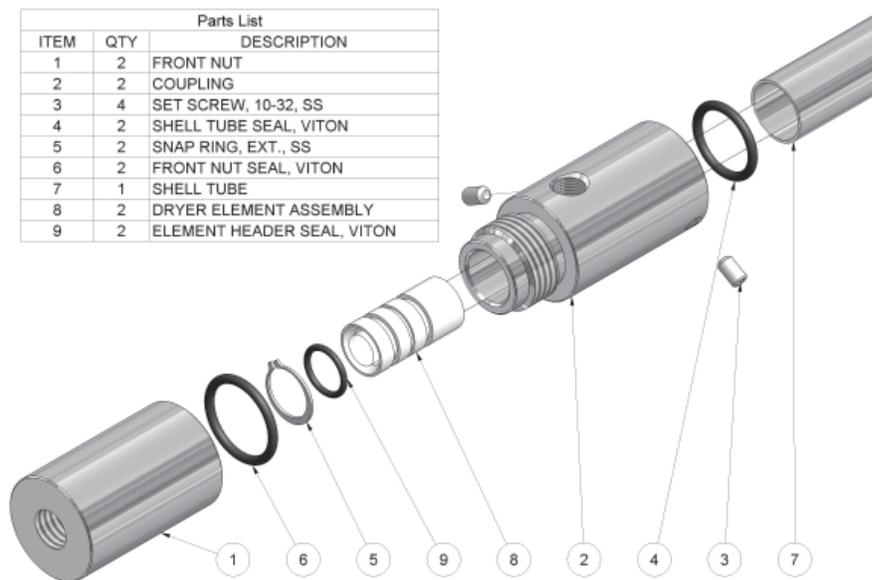
APPENDIX B - PD Dryer Element Replacement

A. PD Dryer with Two Part End Fittings

Tools Needed:

- Allen wrench 3/32
- Snap ring pliers
- Pair of lightweight gloves

1. Hold coupling and shell with one hand, and remove front nut on each end with the other (see Figure below).
2. Loosen set screws on both ends of couplings using Allen wrench.
3. Remove snap ring from both sides using snap ring pliers.
4. Put on pair of lightweight gloves (protects membrane tubing from skin oils contaminating surface and reducing drying efficiency).
5. Pull element header out of housing on one side to expose o-ring. **Do not rotate more than 10° in either direction.**
6. Remove inner o-ring.
7. Gently pull element out other end.
8. Reverse procedure to assemble dryer.



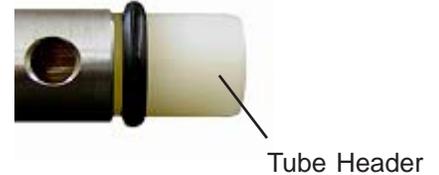
B. PD Dryer with One Part Molded Fitting

TO DISASSEMBLE DRYER

Tools Needed:

- Phillips head screwdriver
- unsharpened pencil with eraser

1. Loosen locking screws on both ends of dryer.
2. Insert eraser end of pencil into one sample port until it rests on tube header face (see Figure on right).
3. Hold dryer vertically and place other end of pencil down onto a hard, slip resistant surface.
4. While supporting shell tube, push lower end fitting down with consistent pressure until it slips off shell tube.
Do not attempt to pull fitting from shell tube; doing this is likely to damage dryer element tubing.
5. Repeat steps 2-4 for other end.
6. Remove one o-ring from tube header .
7. Pull tube element from opposite end of dryer.

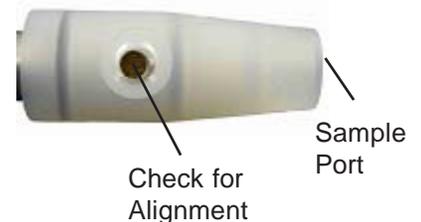


TO ASSEMBLE DRYER

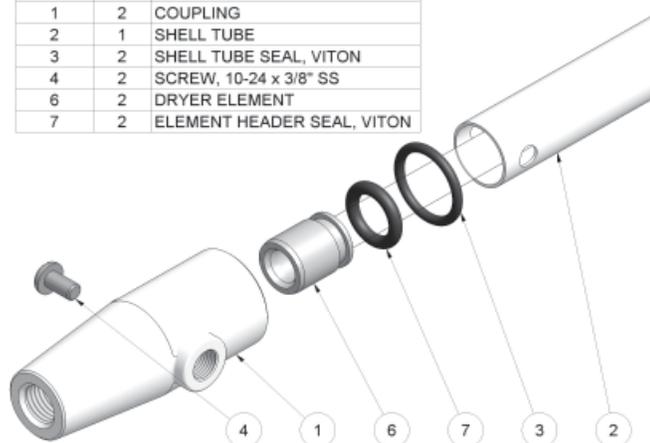
Tool Needed:

- Phillips head screwdriver

1. Install one thick o-ring onto grooved tube header .
2. Slip opposite tube header into dryer shell.
3. Install other thick o-ring onto groove.
4. Push one thin o-ring into groove inside coupling (for SS and AL shells slip o-ring on shell across two holes).
5. Firmly push coupling over tube header.
6. Align purge port with hole in shell tube (see Figure on right).
7. Tighten locking screws until underside of screw head contacts top of boss.
8. Repeat steps 4-7 for opposite end.



Parts List		
ITEM	QTY	DESCRIPTION
1	2	COUPLING
2	1	SHELL TUBE
3	2	SHELL TUBE SEAL, VITON
4	2	SCREW, 10-24 x 3/8" SS
6	2	DRYER ELEMENT
7	2	ELEMENT HEADER SEAL, VITON



APPENDIX C - Replacement Parts List for Ambi-GASS

<u>Part Number</u>	<u>Description</u>
AG-FM	Flow Meter, purge gas (0-60 L/min)
AG-PR	Pressure Regulator, purge gas or eductor
AG-PG-0-30	Pressure Gage, purge gas (0-30 PSI)
AG-VG-0-60	Vacuum Gage, purge eductor (0-30"Hg)
AG-DC	Mounting Clamps for Dryer (specify dryer model)
PD-50T-24E	50 Tube dryer replacement element, 24" long, includes o-rings
PD-100T-24E	100 Tube dryer replacement element, 24" long, includes o-rings
PD-200T-24E	200 Tube dryer replacement element, 24" long, includes o-rings
FF-250-E-2.5G	Replacement filter element
FF-250-G	Replacement glass shell
FF-250-3	Replacement o-ring set, set of 3
AS-200-08-EB	Media replacement for ammonia scrubber, bulk supply, 5 fillings