Mini-GASS™

Gas Analysis Sampling System

User Manual

PERMA PURE

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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 Mini-GASS sample pre-conditioning systems are designed to prepare gas samples for analysis. The Mini-GASS system will remove particulates, mists, and water vapor without removing the compounds being monitored. Figure 1 below gives a general overview of a Mini-GASS system (Model MG-1228).

Standard Features Include:

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

Options:

- Purge Air Dryer
- Sample Pump
- Filter Drain
- Ammonia Scrubber
- Purge Air Eductor
- Z-Purge
- Probe
- Automatic Blowback

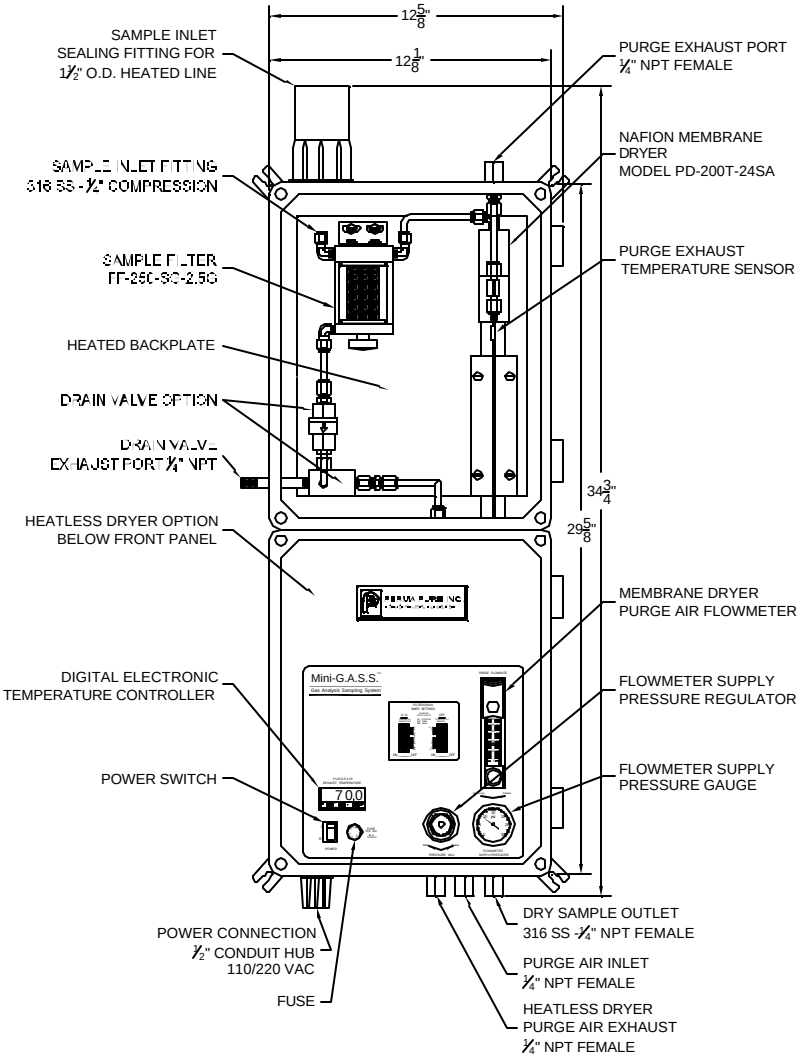


Figure 1

2. Mini-GASS Components

2.1 Probe and Probe Filter (optional):

The Mini-GASS Probe and Probe Filter eliminates the need for a heated line by mounting the conditioning system directly on the stack. Once sample is drawn from the stack, it is passed through a 2 micron ceramic filter to remove oils and acid aerosols. Sample is dried and cooled immediately after removal from stack to minimize changes in sample composition (Refer to Appendix D for Installation Instructions).

2.2 Probe Blowback (optional):

The optional blowback assembly to minimize maintenance of the probe filter by forcing air back through the element and releasing the particles back into the stack (Refer to Appendix D for Installation Instructions).

2.3 Filtration:

The sample is passed through a 1µ filter to remove particulates and aerosols. The standard filter in the Mini-GASS system has a borosilicate glass filter element with a fluorocarbon binder. This element is disposable and will withstand high sample temperatures. In addition to removing particulates, it coalesces liquid aerosols and droplets.

Two flow patterns are possible with this filter:

1. Particulate Filter: Filter installed with flow passing from outside to the inside of the element. With this installation, collected particulates will build up on outside surface of the element allowing visual inspection of its condition.

2. Coalescing and Particulate Filter (See Figure 2): Filter is installed with flow passing from inside of element to the outside. An automatic drain is usually installed to remove the condensate.

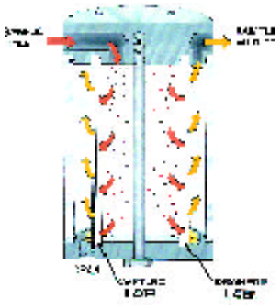


Figure 2

2.4 Automatic Filter Drain (optional):

If coalescing is anticipated, system should be fitted with automatic filter drain to periodically remove collected liquid mists. In most cases, these mists will be acid mists. Automatic drain is available in vacuum or pressurized style.

1. Vacuum Configuration:

   Collected liquid is withdrawn from filter drain port by a vacuum created by an eductor expanding compressed air through a venturi. This is done in cycles and controlled by adjustable digital timer that switches a solenoid valve controlling compressed air supply.

2. Pressurized Configuration:

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 sample.

2.5 Sample Pump (optional):

The sample pump draws the sample and supplies it to the analyzer. It supplies up to 5 liters per minute of sample. The typical pump location is between the filter and the ammonia scrubber. The head of the pump will be located in the heated section of the system, with the motor located in the control section. This configuration keeps pump head at a temperature above dewpoint of the sample preventing condensation from forming.

2.6 Nafion® Dryer:

The Perma Pure Nafion membrane dryer is installed downstream of the filter. As sample enters the dryer, flow splits into a number of small diameter Nafion tubes arranged in a parallel bundle as shown in Figure 3 below. After 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.

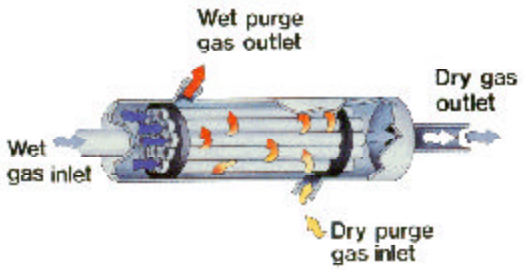


Figure 3

Dry purge gas enters the dryer at the sample outlet end and performs two functions:

1. Provides a medium for water vapor from the sample to be carried away.
2. Creates a temperature gradient along length of dryer.

Ambient purge air enters the dryer at sample outlet, keeping that portion of dryer cooled. This counter current flow is required to produce a temperature gradient along the length of the dryer. To effectively maintain the gradient, the temperature of purge gas exhaust is monitored and controlled by an electronic temperature controller. As purge gas passes through the dryer it is heated to the desired sample inlet temperature. This gradient allows for both rapid vapor removal and decreased final dew point. If the purge gas temperature begins to fall below the programmed temperature, the system's backplate will heat. An aluminum heating block will conduct energy from the backplate to the dryer's shell tube. Purge gas traveling through the dryer's shell acquires heat from the shell. This process allows final temperature of the purge gas to be closely controlled and a consistent temperature gradient will be maintained.

It is important that the dryer removes water in vapor state only. If liquid water is introduced into the dryer, efficiency will decline and the dryer could fail to perform altogether. Tubing elongates approximately 10% over its dry length when saturated with liquid water causing tubing to kink inside housing. Nafion dryers will operate most efficiently when a portion of the dryer is heated to prevent sample from condensing.

2.7 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 any time ammonia is present in sample stream. Ammonia salts can deposit in dryer tubes and cause permanent loss of drying efficiency if not removed from the sample stream. An ammonia scrubber consists of a polysulfone and 316 SS housing filled with a phosphoric acid based media and inert ceramic saddles. This media will require periodic replacement. See section 6.3 for replacement instructions.

2.8 Purge Heatless Air Dryer (optional):

If -40°C dewpoint purge air is not available, a heatless air dryer can be installed in the Mini-GASS to dry the compressed air supply. Outlet of heatless dryer will be connected to standard purge gas flow controls. Operation of heatless dryer is fully automatic and continuous, and should not require any maintenance as long as oil free compressed air is used.

2.9 Purge Air Eductor (optional):

When the sample is under more than five inches of water vacuum, a purge air eductor is required. Eductor generates a vacuum to draw condensate from filter and drop pressure of purge gas to prevent collapsing of Nafion tubing.

2.10 Z-Purge (optional):

For hazardous environments to meet Class I, Division II specifications (Refer to Appendix F).

3. Installation

(Refer to Figure 4 for reference)

3.1 Mounting

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

Probe - refer to Appendix D
Automatic Blowback -refer to Appendix D
Z-Purge - refer to Appendix F
General flow schematic - refer to Figure 4

1. Install Mini-GASS system on vertical surface with dryer/filter compartment on top and control compartment on bottom.

2. Place mounting feet on each corner of enclosure with slotted end protruding at 45 degree angle from enclosure.

3. Drop mounting screw in from top and tighten into foot.

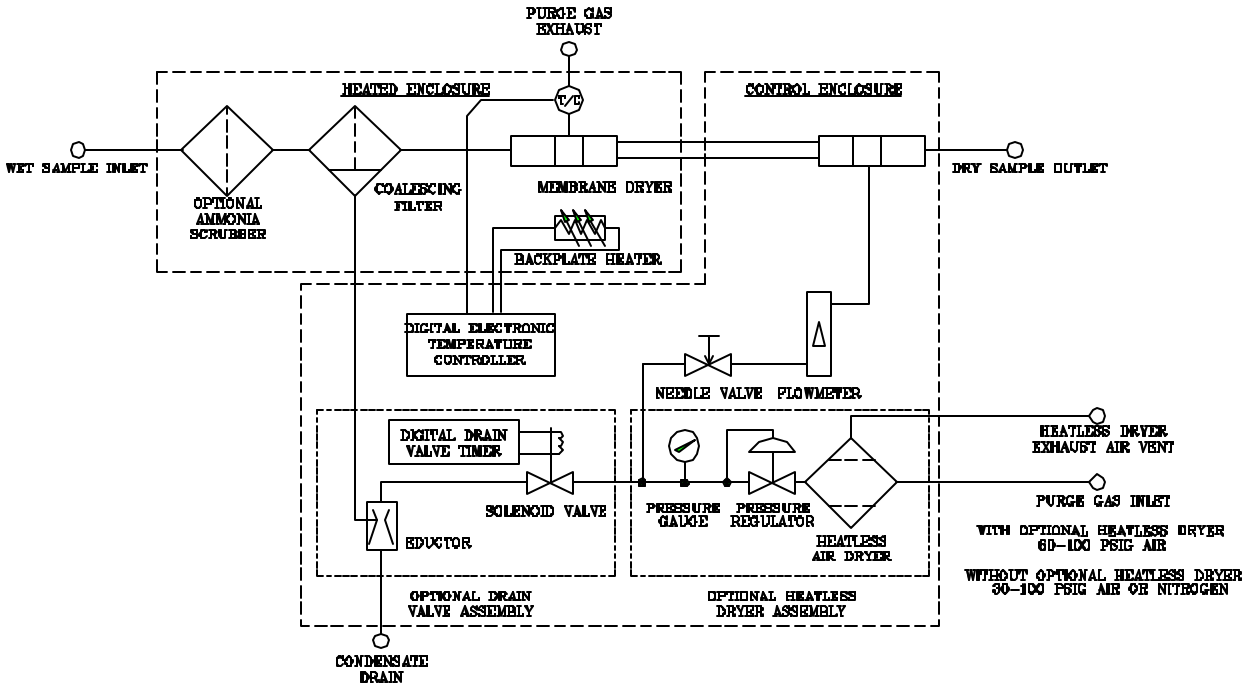


Figure 4

3.2 Electrical Connection

Mini-GASS Model # 1220, 1214, and 2812P (Portable) have a power cord and plug for 110 VAC and a power cord with pigtail wires for the 220 VAC version.

Mini-GASS Model # 1228 and 1235: Connect power supply line to terminal block located on the backplate of the control enclosure inside 1/2" conduit hub. Refer to Figure 5 for color coding.

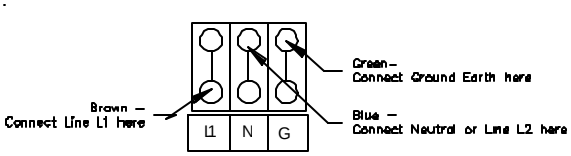
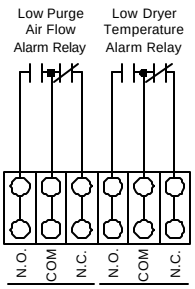


Figure 5

Alarm Relays: The SIVS2 has a 6 pole terminal block that will allow for field wiring of alarm relays for connection of external alarm equipment (refer to Figure 6). Relay contacts are rated at 250 VAC, 3A resistive.



Note: It is recommended that a fused disconnect (not provided) be installed in power line coming into system. Power can then be shut off before performing any maintenance or service procedures.

Figure 6

3.3 Plumbing

a. Sample Connection - Mini-GASS with Probe refer to Appendix C

With Optional Heated Line

1. Install heated line sealing fitting by threading hub into sleeve.
2. Ensure o-ring seal is installed on outside of enclosure (between sleeve and enclosure wall).
3. Run heated sample line through entry seal and into enclosure.
4. Connect sample line to compression fitting (labeled “Wet Sample In”).
5. Shrink entry seal tubing around heated sample line with heat gun.
6. Connect sample outlet port of Mini-GASS to sample line running to analyzers. High temperature heated line is not necessary for this connection. If sample line will be exposed to freezing temperatures, freeze protected line is suggested.

Without Heated Line

1. Connect sample line to bulkhead fitting (labeled “Sample Gas In”).
2. Connect sample outlet from Mini-GASS (labeled “Dry Sample Out”) to sample line running to analyzer.

b. Purge Air Supply

Instrument Air

Purge gas must be of instrument grade with dew point no higher than –40^{O}C.

1. On model MG-1214, purge gas should be supplied to dryer via 0-30 slpm flowmeter and regulator capable of supplying 0-50 psig. All other models come with control panel which includes flowmeter and regulator.
2. Connect regulated purge gas supply line to 1/4" female NPT purge inlet port of membrane dryer (labeled “Instrument Air”).

Heatless Dryer (Optional)

1. Connect oil free compressed air line to port (labeled “Purge Gas Inlet”). An oil coalescing pre-filter is recommended.
2. A 1/4” female NPT bulkhead fitting on bottom of enclosure is heatless dryer purge air exhaust. Humid air can be vented to atmosphere or piped to remote location.

c. Filter Drain Connection

Connect line from eductor outlet to designated collection/exhaust basin containing acid absorption media to prevent release of exhaust to surrounding. 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.

d. Purge Exhaust

Purge exhaust may contain liquid water. A line can be connected from purge outlet to remote area if desired. Line should not restrict purge flow. 1/4" I.D. tubing can be used for runs up to 10 feet, or larger I.D. tubing for longer exhaust lines.

e. Purge Eductor Inlet Connection

Connect air supply line to compression fitting (labeled “Instrument Air”).

f. Steam Connection (Optional - Refer to Figure 7)

1. Insulate supply line to steam control valve.

2. Insulate supply line between valve and steam coil.

3. Supply low pressure steam (50 psig max.) to steam coil. Do not exceed this pressure or overheating may occur.

Outlet end of steam coil located at lower left side of enclosure is connected to a thermostatic steam trap to allow condensed steam to drain in a controlled manner. Condensate can be piped to a wastewater drain or to condensate recovery system.

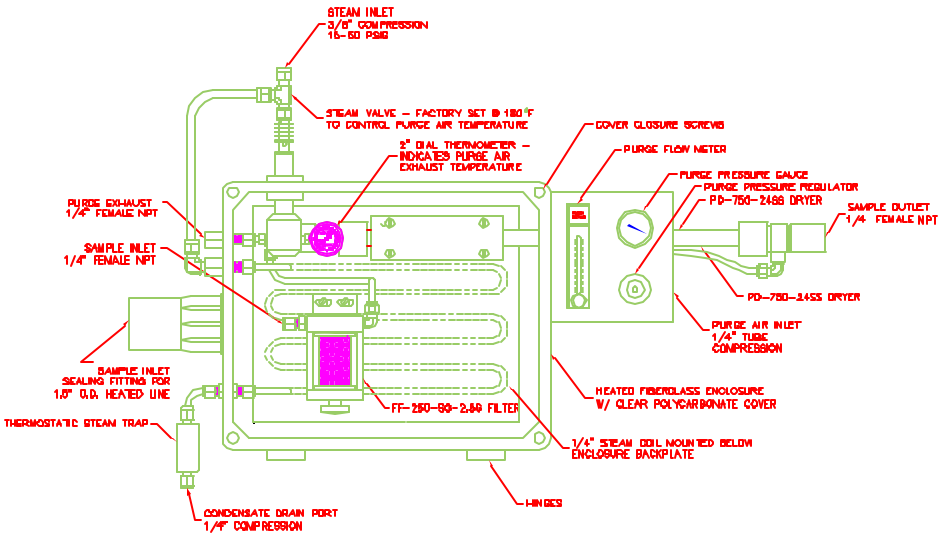


Figure 7

4. Start-Up Procedure

4.1 Setup Check

1. Check that electrical, sample, purge, drain, and/or steam connections have been made.

2. Turn on compressed or instrument air to system.

4.2 Automatic Filter Drain Control (Optional)

Automatic filter drain is controlled by a repeat cycle timer that operates a solenoid valve. Two DIP switches are located on timing device to control drain and cycle times located on backside of control panel.

Standard factory setting is to 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 hour (1st switch on – all others off) to 1023 hours (all switches on)

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

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

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

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

4.3 Temperature Control

PID Electronic Temperature Controller

1. Press and hold "★" key (Refer to Figure 8).

2. Press either up or down key to adjust setpoint. Setpoint temperature will change one °C with each press of arrow key.

3. When desired temperature is reached, release both keys.

NOTE: MG-1228, 2812P, and 1235 systems have a low temperature alarm that is programmed into controller. Default temperature setting for alarm is 5^{O}C below setpoint temperature. Refer to enclosed CAL Controls temperature controller manual and for more information.

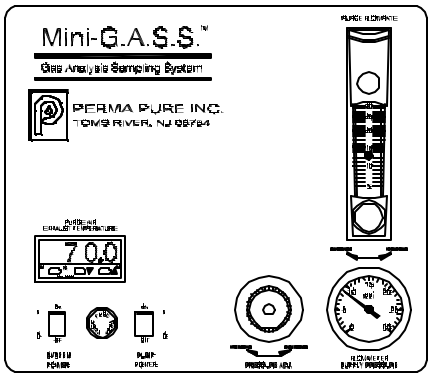


Figure 8

Steam Temperature Control

Steam heated systems are regulated by a thermostatic steam control valve located in the purge air exhaust stream. This valve is preset at the factory to an appropriate temperature determined by sample conditions. A typical setpoint temperature is 180^{O}F which is the approximate temperature of the purge air exhaust as indicated by analog thermometer located in the purge air exhaust stream.

Safety Interlocks (SIVS2)

Systems equipped with the SIVS2 interlock option automatically shuts off the sample pump or sample control valve in the event of low purge airflow or low temperature in the system. To accomplish this, a differential pressure switch in the purge air inlet senses the flow of purge air and energizes a relay. This relay then sends power to the contacts of a second relay, which will energize only when the temperature set point has been reached. After energizing, this second relay sends power to the sample valve and the valve will open and allow sample flow. Under normal operating conditions both safety relays will remain energized (When the system is operating normally, open contacts will close and remain closed). Alarm relays may be field wired to initiate an external alarm.

4.4 Preheating the System

1. Turn on AC power or steam to system.

WARNING!

On AC powered units, temperature control display should light. ***DO NOT BEGIN SAMPLE FLOW AT THIS TIME!*** Check purge air is flowing immediately after turning on AC power or steam. If, for any reason, there is no purge air or flow is inadequate, turn off AC power or steam before attempting to locate problem. ***OPERATING SYSTEM WITH LITTLE OR NO PURGE AIR CAN CAUSE DAMAGE TO MEMBRANE DRYER ASSEMBLY.***

2. Set purge air pressure to 15 psig.

3. Adjust purge air flow to 20 l/min.

4. Set purge air eductor vacuum level to 5 in-Hg (if applicable).

5. Ensure purge air is exhausting from system.

6. On systems with SIS2 or SIVS2 option, temperature controller will be alternately displaying **-AL-** and actual purge air exhaust temperature until purge air temperature comes within 5 ^{O}C of setpoint temperature.

7. Allow 15 - 30 minutes of additional heating time after system has come to setpoint temperature. Sample flow may be started. For Mini-GASS with a pump, when set on “AUTO” mode, pump will turn on when unit has reached temperature and purge gas is sensed.

5. System Fine Tuning

Temperature Adjustment

5.1. Steam Heated Systems

Steam control valve is factory set to 180^{O}F and is normally not field adjustable. This temperature is adequate for most applications in which sample gas water content is not in excess of 50% water vapor by volume. Consult factory if condensation in sample tubing is detected.

5.2. Electrically Heated Systems

1. Check that no condensate is present in sample line between filter and dryer.

2. If water droplets are visible, increase temperature of filter/dryer compartment by **5**°C.

3. Allow about ½ hour for system to stabilize and then check again for condensate.

4. If necessary, continue to increase temperature at 5°C intervals until condensate is no longer visible. Do not exceed 100°C! Maximum system temperature is **100**°C. Operation above this temperature can cause damage to Nafion dryer. ***It is essential that purge gas flows continuously and setpoint temperature is not above 100°C to prevent damage to dryer.***

6. Maintenance

6.1 Filters

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

Filter Element Replacement
(Refer to Figure 9)

1. Loosen bolt on bottom of filter.
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 caps 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 over-tighten center bolt. It should be just tight enough so it does not vibrate loose. Over-tightening will not help the filter to seal.

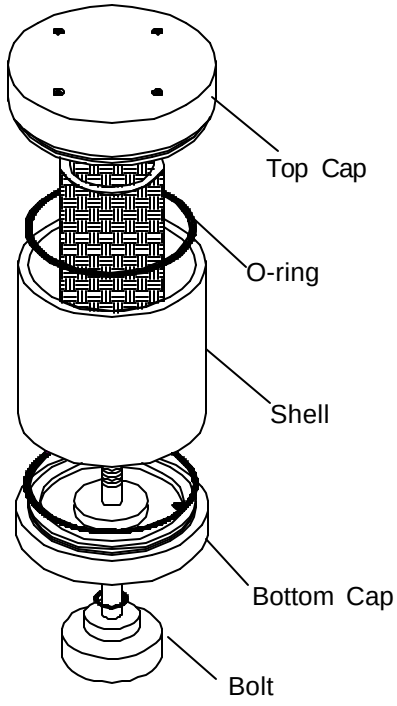


Figure 9

6.2 Dryers

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

Refer to Appendix B for PD dryer element replacement.

6.3 Ammonia Scrubber

Media Replacement:

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

1. Unscrew thumbscrew on bottom of housing.
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 (rinse housing 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 finger tighten thumbscrew (**do not overtighten**).

6.4 Fuse

Fuse Replacement

1. Turn cap marked “FUSE” counter-clockwise ¼ turn and the fuse holder will come out.
2. Remove the 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 ¼ turn clockwise.

APPENDIX A

1. Specifications

MAXIMUM SAMPLE FLOW RATE:	0 TO 10 LITER/MIN
MAXIMUM INLET SAMPLE TEMPERATURE:	250°F W/SST FILTER 230°F W/KYNAR FILTER
MAXIMUM GAS SAMPLE WATER VAPOR CONTENT:	30%
OUTLET SAMPLE DEW POINT:	
(With PD-200T-24SS dryer)	26°F (-4°C) at 10 L/MIN 12°F (-12°C) at 5 L/MIN -12°F (-25°C) at 2 L/MIN
(With PD-100T-24SS dryer)	36°F (2°C) at 10 L/MIN 26°F (-4°C) at 5 L/MIN 6°F (-15°C) at 2 L/MIN
(With PD-50T-24SS dryer)	42°F(5°C) at 10 L/MIN 34°F(1°C) at 5 L/MIN 22°F(-6°C) at 2 L/MIN
SOLUBLE GAS REMOVAL RATES:	NO, NO2 0% loss SO2 0% loss CO, CO2 0% loss H2S, HCl 0% loss
MAXIMUM GAS SAMPLE INLET PRESSURE:	20 PSIG
MINIMUM GAS SAMPLE INLET PRESSURE:	
- WITHOUT PURGE EDUCTOR OPTION:	5" H2O VACUUM
- WITH PURGE EDUCTOR OPTION:	10” 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:	110/220VAC, 50/60Hz, 5.0A/2.5A (475 WATTS)
FUSE:	5 AMP BUSS TYPE AGC OR EQUIVALENT
ENCLOSURE:	NEMA 4X, FIBERGLASS WITH POLYCARBONATE COVER
DIMENSIONS:	
- MG-1228	12”W x 28”H x 7”DEEP
- MG-2812P	28”W x 12”H x 7”DEEP
- MG-1220	12”W x 20”H x 7”DEEP
OPERATING ENVIRONMENT:	-20°C TO 40°C AMBIENT TEMP. 0 TO 95% R.H.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
8/9/01	A	CHG SPLICE LOCATIONS & ADDED RELAYS	PS	GP	
8/9/01	A	ADDED MAS 90 #'s, GROUND WIRE & COLOR	PS	GP	

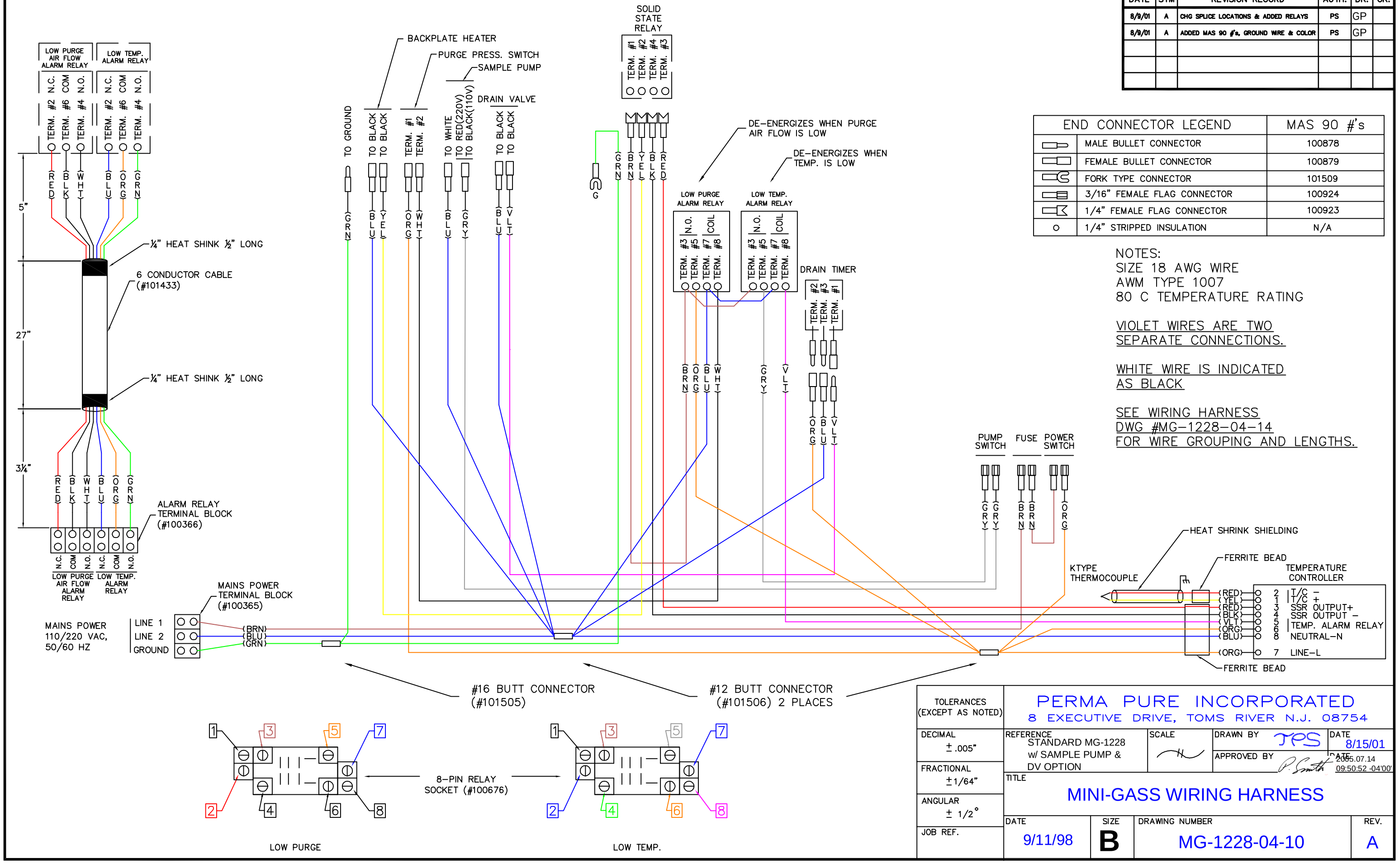
END CONNECTOR LEGEND		MAS 90 #'s
	MALE BULLET CONNECTOR	100878
	FEMALE BULLET CONNECTOR	100879
	FORK TYPE CONNECTOR	101509
	3/16" FEMALE FLAG CONNECTOR	100924
	1/4" FEMALE FLAG CONNECTOR	100923
○	1/4" STRIPPED INSULATION	N/A

NOTES:
SIZE 18 AWG WIRE
AWM TYPE 1007
80 C TEMPERATURE RATING

VIOLET WIRES ARE TWO SEPARATE CONNECTIONS.

WHITE WIRE IS INDICATED AS BLACK

SEE WIRING HARNESS DWG #MG-1228-04-14 FOR WIRE GROUPING AND LENGTHS.



TOLERANCES (EXCEPT AS NOTED)	PERMA PURE INCORPORATED 8 EXECUTIVE DRIVE, TOMS RIVER N.J. 08754		
DECIMAL ± .005"	REFERENCE STANDARD MG-1228 w/ SAMPLE PUMP & DV OPTION	SCALE	DRAWN BY PS 8/15/01
FRACTIONAL ±1/64"			APPROVED BY P. Smith 2005.07.14 09:50:52 -04'00'
ANGULAR ± 1/2°	TITLE MINI-GASS WIRING HARNESS		
JOB REF.	DATE 9/11/98	SIZE B	DRAWING NUMBER MG-1228-04-10 REV. A

APPENDIX B

1. PD Dryer Replacementwith 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 (Refer to Figure 10).*
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.*

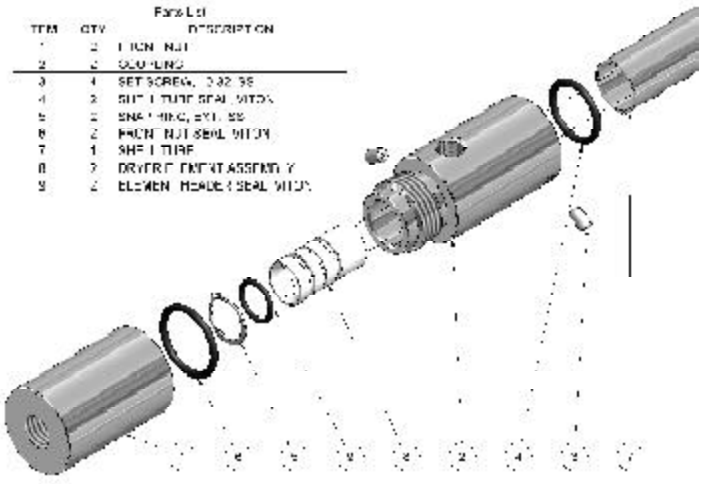


Figure 10

2. 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 (Refer to Figure 11).*
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.*

Figure 11

TO ASSEMBLE DRYER (Refer to Figure 13)

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 (Refer to Figure 12).*
7. *Tighten locking screws until underside of screw head contacts top of boss.*
8. *Repeat steps 4-7 for opposite end.*

Figure 12

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

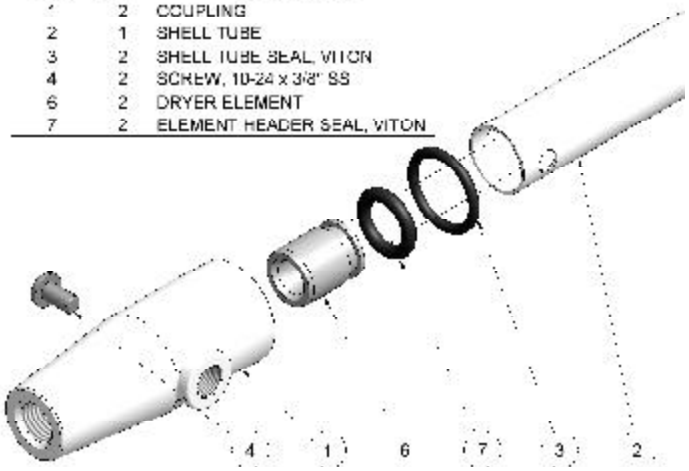


Figure 13

APPENDIX C

1. Replacement Parts List for Mini-GASS

Part #	Description
MG-DTC	Digital Temperature Controller, Single Channel
MG-TCS	J-Type Thermocouple
MG-SSR	Solid State Relay
MG-FM	Flow Meter, purge gas (0-60 L/min)
MG-PR	Pressure Regulator, purge gas or eductor
MG-DPS	Differential Pressure Switch for Purge Flow Detection
MG-PG-0-30	Pressure Gage, purge gas (0-30 PSI)
MG-VG-0-60	Vacuum Gage, purge eductor (0-30"Hg)
SV-K10	Safety Interlock Solenoid Valve, Kynar, 110V/60Hz
SV-K20	Safety Interlock Solenoid Valve, Kynar, 220V/50Hz
FF-DCV	Drain Check Valve, Polypropylene, for vacuum drain
DVV-B10	Drain Solenoid Valve, Brass, for vacuum drain 110V/60Hz
DVV-B20	Drain Solenoid Valve, Brass, for vacuum drain 220V/50Hz
DVP-K10	Drain Solenoid Valve, Kynar, for pressure drain 110V/60Hz
DVP-K20	Drain Solenoid Valve, Kynar, for pressure drain 220V/50Hz
MG-DVT	Drain Valve Timer
MG-DC	Mounting Clamps for Dryer (specify dryer model)
MG-1412-HB	Backplate with Heater for Enclosure 1412
MG-2112-HB	Backplate with Heater for Enclosure 2112
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
MG-PUMPKIT	Pump repair kit, Teflon diaphragm
SP-270E	Ceramic Filter Element for MG-1228

APPENDIX D

1. Flange Mounted with Integral Sampling Probe and Filter Blowback Installation

Flange mounted Mini-GASS® is designed to be stack mounted on 2", 3" or 4" pipe flange. The integral sample probe and filter eliminates need for a heated umbilical line to connect stack gas sampling probe to sample conditioning system.

The Mini-GASS system is attached directly to sample port flange by following the steps below:

1. Attach flange to sampling port using appropriate sized gasket and bolts.
2. Align flange holes with turnbuckle anchor at bottom. Install four appropriate sized bolts and hand tighten all four bolts evenly. Tighten with wrench (see Figure 14).
3. Install sampling probe pipe into pipe flange by inserting non-threaded end of probe pipe through flange (see Figure 15). Probe should extend into the center of the stack and pointing slightly downward to allow any entrained liquid to drain back into the stack.
4. Tighten probe pipe into flange with wrench.
5. Attach one end of turnbuckle to anchor at bottom of flange and fix pin in place with cotter pin.

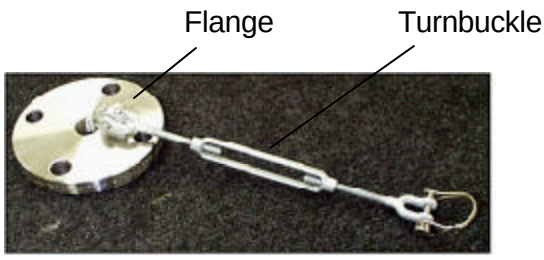


Figure 14

Figure 15

6. If system is being installed with automatic filter blow back option, install blow back system on right flange bolt (refer to Figure 16).

7. Attach pre-bent SS tubing to Mini-GASS and to blowback assembly.

8. Lift Mini-GASS system into place so union fitting on back of system can be attached to probe pipe. This is most easily accomplished with help of an assistant.

9. While holding system in place, tighten union hand tight.

10. Connect free end of turnbuckle to anchor point at middle back of system (refer to Figure 17).

11. Attach with stainless clevis pin.

12. Snap keeper wire into place.

13. ***Adjust turnbuckle by turning it out to increase length until union fitting is straight.*** Turnbuckle is used only to relieve torsional load from union fitting.

14. Tighten union fitting with a wrench.

15. Install insulation between flange and back of Mini-GASS.

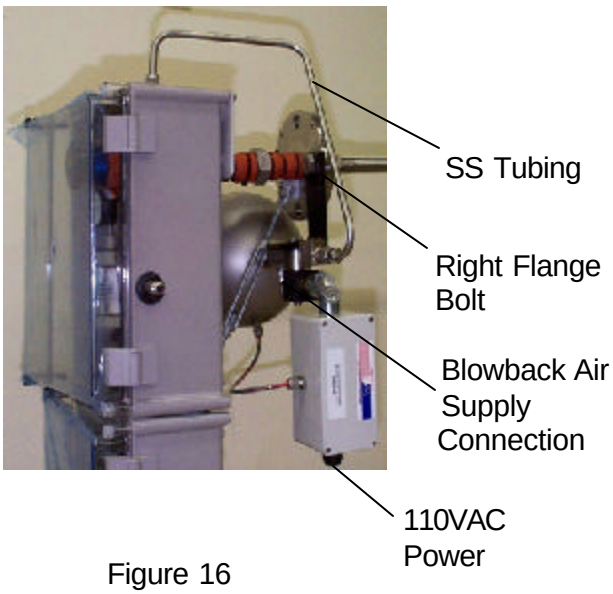


Figure 16

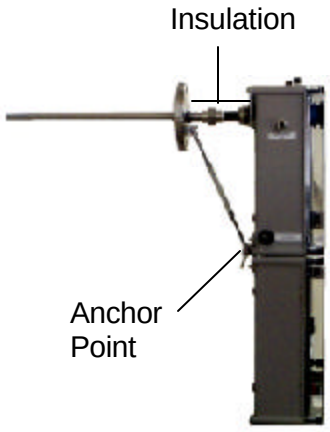


Figure 17

2. Plumbing

1. Connect blowback air line to blow back inlet port on the Mini-GASS.

2. Connect cal gas line to fitting labeled “Cal Gas Inlet”.

3. Connect 110VAC power to blow back timer ***Note: This also provides power to the filter in the probe.***

3. Blow Back Operation

The blow back option includes a timer circuit which will initiate the blow back cycle based on a regular, adjustable time period. The time cycle control turned to the far left will cycle the blow back every 15 minutes. At the far right side, the period of time between cycles is about 24 hours. The period of time between blow back cycles should be calculated to occur as often as when the filter has trapped one gram of particulates but no less frequently than once per day.

A jumper placed between “AUTO OFF”and “COM” will disarm the timer. A contact closure between terminals labeled “MAN B-B” and “ COM” will initiate a blow back cycle.

The blow back solenoid valve will be opened for 2 seconds when the blow back cycle is started.

4. Startup

Return to Mini-GASS Startup Section 4 on pages 14-16.

5. Maintenance

Changing the Filter in Blow Back/Probe Assembly

1. Unscrew black filter cap inside Mini-GASS system (use gloves if hot to touch).

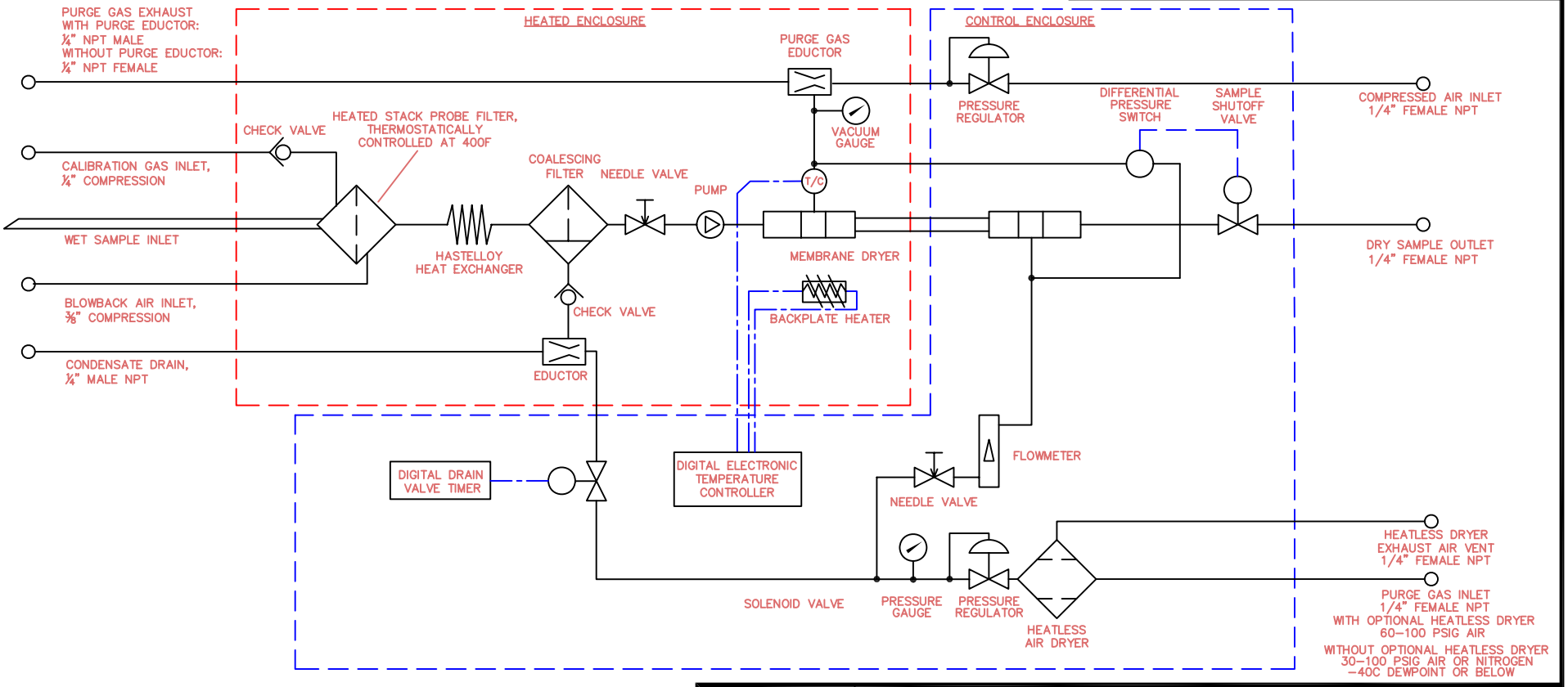
2. Filter is now exposed. With a pair of pliers, pull out the old filter.

3. Inspect o-ring which are at each end of filter. Replace if they are charred or deformed.

4. Place new filter element using pliers. Ensure it is centered and in contact with o-ring.

5. Screw cap back on the filter body.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



TOLERANCES (EXCEPT AS NOTED)	PERMA PURE INCORPORATED 8 EXECUTIVE DRIVE, TOMS RIVER N.J. 08754			
DECIMAL ±.005"	REFERENCE INTEGRAL SAMPLING PROBE SYSTEM w/ DV, HD, PUMP & PURGE EDUCTOR	SCALE	DRAWN BY GP	DATE 8/23/01
FRACTIONAL ±1/32"			APPROVED BY P. Smith	DATE 2005.07.14 09:50:52 -04'00'
ANGULAR ± 1/2°	TITLE PIPING AND INSTRUMENTATION			
JOB REF.	DATE 8/23/01	SIZE A	DRAWING NUMBER MG–0000–01–08	REV. –

APPENDIX E - Mini-GASS Drawings

Diagram 1. MG-1228 Style System

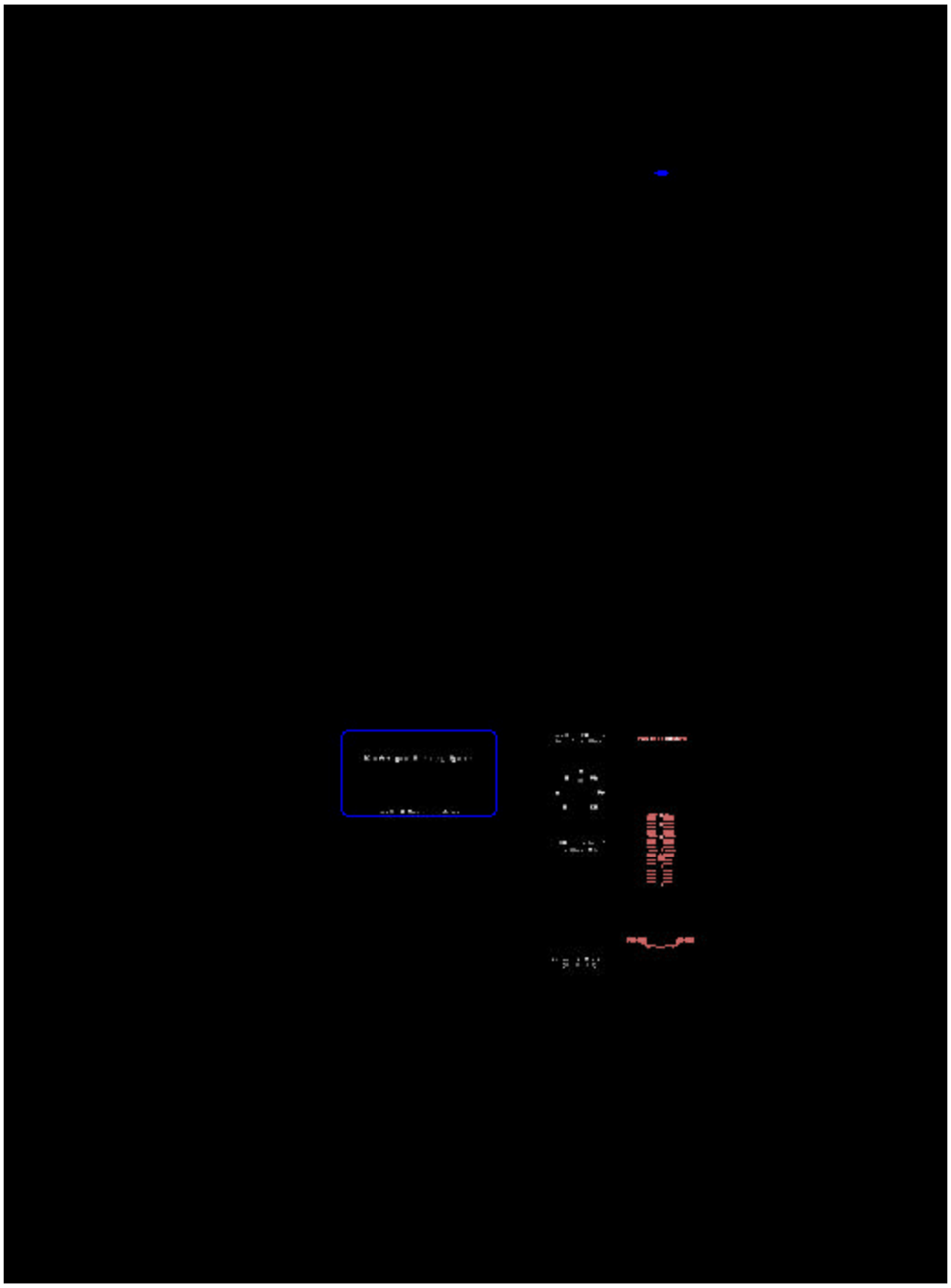


Diagram 2. MG-1220 Style System

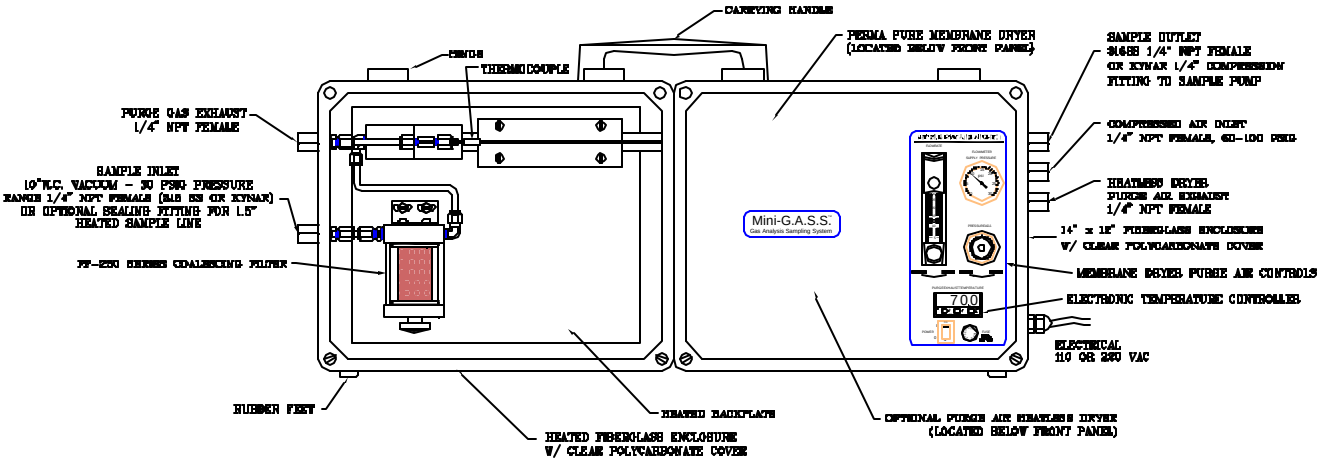


Diagram 3. MG-2812P Portable System

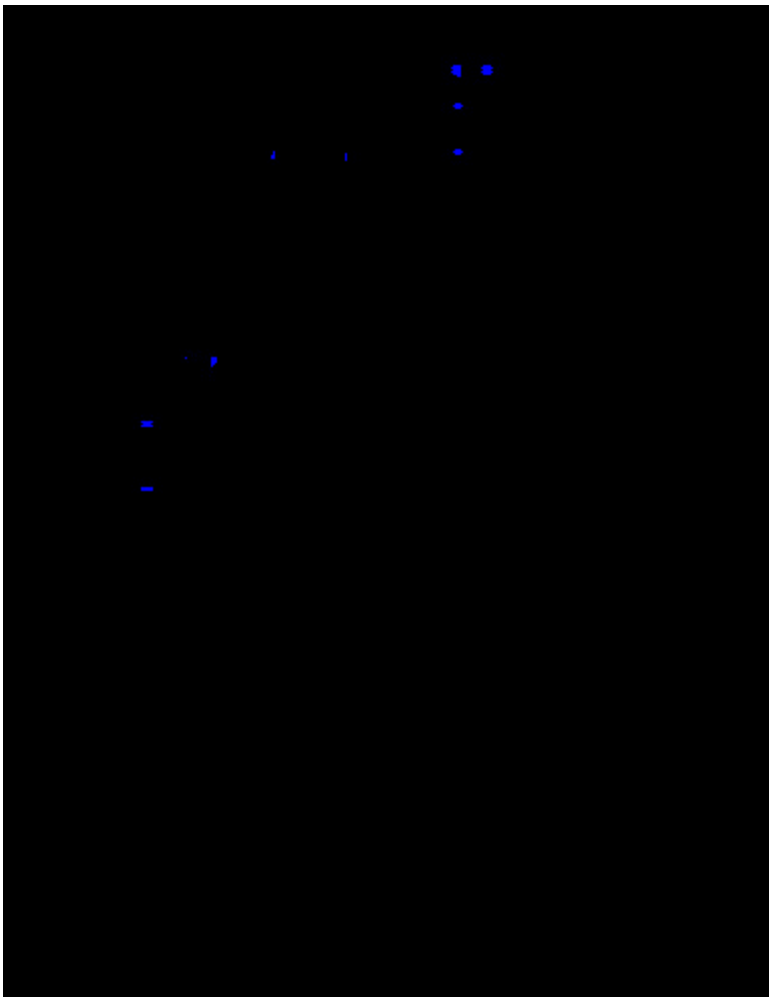


Diagram 4. MG-1228 Steam System

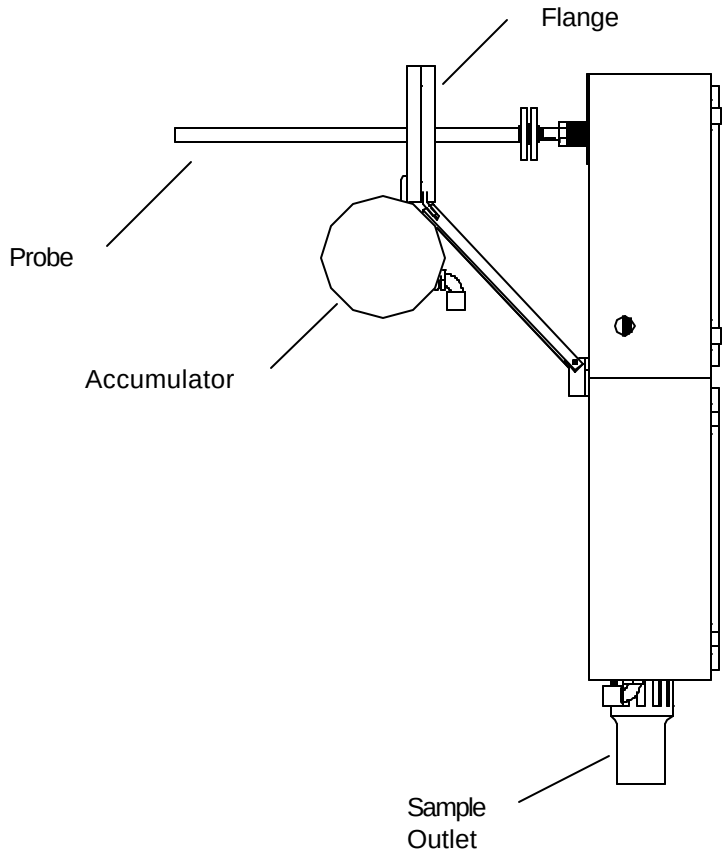


Diagram 5. MG - 1228 with Probe and Blowback

APPENDIX F

1. Z-Purge Operation

With the inert gas supply connected, enclosure power deenergized and alarm system (if utilized). Follow steps to purge system:

1. Carefully read Start-Up Instruction Nameplate on system.
2. Check operation of the Enclosure Protection Vent (EPV-1, if utilized), opening it manually several times (see helpful hints below)
3. Seal protected enclosures.
4. Open Enclosure Pressure Control Regulator, but turning CW, to set Enclosure Pressure Indicator at “Safe” pressure.
5. Ensure the Protection System Enclosure Pressure Indicator maintains a “Safe” pressure for one minute.
6. Standby for exchange time as specified on the Instruction Nameplate, then energize the protected enclosure power.
7. Ensure the Enclosure Pressure Indicator maintains a “Safe” pressure before leaving system unattended.

2. Troubleshooting

Problem or Fault	Possible Causes	Corrective Action
Enclosure pressure control regulator will not hold a safe pressure.	Leakage around gasketing, covers, seams, piping and tubing connections, conduit connections and electrical conduit seal of the enclosure.	Tighten enclosure latches: silicone sealant can be applied from inside the protected enclosure where tightening is not feasible.
Enclosure pressure indicator reading is difficult to stabilize.	Insufficient enclosure leakage or opening of the venture orifice is crimped too small.	Remove the orifice, cut off crimped end and ream tube, then recrimp and reinstall tube. As tube is shortened, sensitivity decreases allowing easier setpoint on the enclosure
Enclosure Pressure Indicator “Drifts” up or down from the “Safe” pressure setting.	Application involves a small, tightly sealed enclosure and/or a fluctuating protective gas supply.	Pre-regulate gas supply upstream of the enclosure protection system to 5 psi maximum
Enclosure pressure loss alarm switch does not appear to be operating.	Pressure switch is out of calibration.	Calibrate by slowly adjusting counterclockwise to decrease setpoint and clockwise to increase setpoint.

3. Helpful Hints

- The term “Safe” pressure for purposes of this manual is defined as follows:
  Class I = a minimum 0.25 inch of water column pressure.
  Class II = a minimum 1.0 inch of water column pressure.
- Regulator may be in the locked position upon arrival. To adjust regulator, pull handle to outward position.
- To test the vent’s operation, gently prod the vent flapper open with a soft pointed object (i.e. eraser end of pencil) ensuring that the vent works freely.