

## **Mini-GASS™**

### Sample Conditioning System User's Manual

Rev 01



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## **Unpacking**

Perma Pure has made every effort to ship you a high quality product that has been thoroughly inspected and tested. It has been carefully packed to ensure that it arrives at your facility in good condition. Even though every effort has been made to prevent damage during transportation, damage can occur by the carrier. This is out of Perma Pure's control and is the responsibility of the carrier to ensure that your equipment arrives intact and undamaged.

- ❖ Inspect outside packaging. If there is any visible damage, inform the carrier at the time of delivery. ***This inspection is important! Once the package is signed for, responsibility for any visible damage then transfers to the consignee.***
- ❖ Unpack your equipment. Visually inspect the outside of your equipment for any damage. If there is any damage, ***contact the carrier immediately.*** Generally, a carrier must be notified within 24 hours of the delivery to make a hidden damage claim. Save the packing material in the event a damage claim must be verified by the carrier.

### **Items in the carton include:**

- (1) Mini-GASS sampling system
- (1) Heated line seal fitting
- (1) User's Manual

If any of the above parts are missing or damaged, call the helpline at:

**(800) 337-3762**

Or visit our website at:

**[www.permapure.com](http://www.permapure.com)**

# 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.

This publication is based on information that was available at the time it was printed. At Perma Pure we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without any obligation. This publication may also discuss features that may not be available in certain revisions of the product.

This equipment is to be installed and operated by trained personnel, with sufficient command of the English language to clearly understand the instructions and safety warnings.

## **TRADEMARKS**

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### **Important safety warnings**

**Please be sure to review the following basic safety procedures. These procedures represent the MINIMUM requirements to operate the equipment safely. It is the ultimate responsibility of the operator to ensure proper safety practices are utilized at the point of operation.**

- This equipment is **NOT** designed to operate in a wet environment.
- **Condensate is potentially dangerous. NEVER** handle drain lines or any other item that may have come in contact with the gas stream or any hazardous material, without adequate personal protective equipment. **ALWAYS** assume that any liquid present is hazardous.
- **Sample gas is potentially dangerous.** A leak test is recommended at initial startup and as often as necessary to maintain a safe working environment around the equipment. The gas stream exhaust must exit away from all personnel to prevent dangerous exposure.
- **NEVER operate the equipment with any part of the enclosure unsecured.** All operated doors and covers must be in place and secured prior to operation. Electrical current may be present behind covers or doors, even if tools are not necessary to access these components.
- **NEVER** attempt service on this equipment without first disconnecting all energy sources. Repair of this equipment should only be done by properly trained personnel that are familiar with the potential risks involved with servicing of the equipment.
- **NEVER** replace fuses with types other than the sample specification of type and current. Do not bypass this or any other safety device.
- **NEVER** operate this equipment if it is visibly damaged or the possibility exists that it may have been damaged.
- The use of components that have not been purchased through an authorized Perma Pure dealer or directly from Perma Pure may compromise the safety of the operator. Additionally, use of non-authorized components may change the operating characteristics of this equipment. Any changes to the equipment that modify its operation in any way are dangerous, and are strictly prohibited.
- Read the entire operating manual before attempting to set up or operate the equipment.
- Please heed all warning labels that are on the equipment. They are there to remind you of possible hazardous conditions.
- Verify the integrity of any mechanical and/or electrical connections that are made to the unit.
- Verify that the unit is connected to the proper rated power for the system.
- Verify that the unit is plumbed properly to operate effectively.

## General description

Proven tube-in-shell membrane technology is the basis of the Mini-GASS™ Conditioning System, which selectively removes water vapor from a gas stream. The driving force is the vapor pressure differential between the sample gas and a purge gas counter-flowing outside the tubing. This difference quickly dries the gas stream.

The Mini-GASS standard features include a heated enclosure, particulate and/or coalescing filter, Nafion® gas dryer, temperature controller and dryer purge flow controls. There are also a number of options which may have been included in your system. See Figure 1

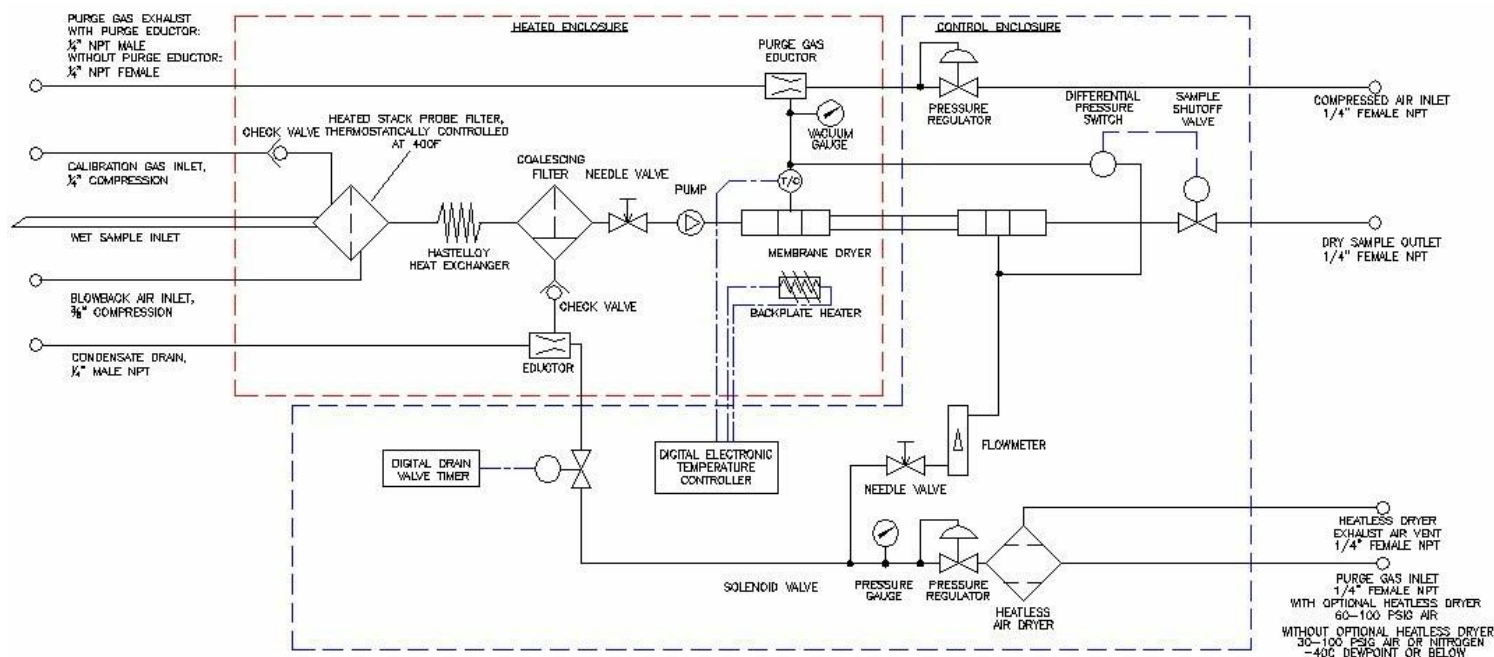


Figure 1  
Mini-GASS flow diagram

## **Specifications and Features**

Sample flow rate	0 to 10 lpm
Sample inlet temperature	250°F (121°C) max. with stainless steel filter 230°F (110°C) max. with Kynar filter
Sample inlet water vapor	30% by volume maximum non condensing
Sample inlet pressure: Without purge eductor option With purge eductor option	maximum 20 psig; minimum 5" H <sub>2</sub> O vacuum minimum 10" H <sub>2</sub> O vacuum
Purge air requirements	Maximum 1 cfm of oil-free instrument air or nitrogen with less than -40°C dew point
Cooling Manifold (w/sample pump) Heatless Dryer compressed air requirement	2 CFM clean, dry air @ 80PSIG 60-100 PSIG
Outlet sample dew point With PD-200T-24SS dryer	26° F (-4° C) at 10 lpm 12° F (-12° C) at 5 lpm -12° F (-25° C) at 2 lpm
With PD-100T-24SS dryer	36° F (2° C) at 10 lpm 26° F (-4° C) at 5 lpm 6° F (-15° C) at 2 lpm
With PD-50T-24SS dryer	42° F (5° C) at 10 lpm 34° F (1° C) at 5 lpm 22° F (-6° C) at 2 lpm
Gas sample inlet and outlet fittings	¼" or 3/8" tubing fittings
Electrical requirements	115V ±10% or 230V ±10%, 50/60Hz, 5.0A/2.5A (up to 914 Watts depending on options)
Fuse	3A or 5A BUSS type AGC or equivalent
Enclosure	NEMA 4X, Fiberglass with polycarbonate cover
Dimensions: MG-1228 MG-2812P	12" W x 28" H x 7" Deep 28" W x 12" H x 7" Deep
Operating environment	-20°C to 40°C ambient temperature; 0-95% RH Altitude – up to 2000m

## **Installation**

### **Mounting**

1. Install Mini-GASS 1228W or 1228p system on vertical surface with dryer/filter compartment on top and control compartment on bottom. Model 2812T operates horizontally (Left to Right).
2. Place mounting feet (if used) on each corner of enclosure with slotted end protruding at a 45° angle.
3. Drop mounting screw in from top and tighten into foot.

### **Connections** (Refer to figure 2)

#### **Heated sample 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 & 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 recommended.

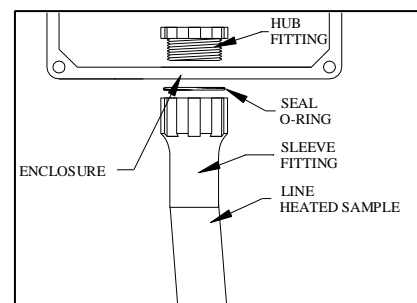


Figure 2

#### **Purge air supply Instrument air**

*Purge gas must be of instrument grade with dew point no higher than -40°C.*

1. All models come with a control panel that includes a flow meter and regulator.
2. For all models, connect a 30-100 psig purge gas supply line to the ¼" female NPT purge inlet port of membrane dryer labeled "Instrument Air".

#### **Heatless air dryer (optional)**

1. Connect oil-free compressed air line to port labeled "Purge Gas Inlet"
2. A ¼" FNPT bulkhead fitting on bottom of enclosure is the heatless dryer purge air exhaust, see figure 3. Humid air can be vented to atmosphere or piped to a remote location. Use suitable size piping.



## **Purge air exhaust**

**Failure to properly vent the system may result in personal injury and/or property damage!**

The gas exhausted from the purge exhaust port under normal operation is humid air. However, in the event of an internal failure of the sample gas dryer installed in the system, the exhaust may contain sample gas that may be hazardous. The purge exhaust must be permanently routed to a vent system or directly outdoors. Do not allow the purge to vent into a structure or confined space.

Connect tubing or pipe of an appropriate material from the purge exhaust outlet to a permanent vent designed for this type of discharge. 1/4" I.D. tubing can be used for runs up to 10 feet. Use larger I.D. tubing for longer exhaust lines. Too small of an ID and/or too long of a piping run will cause inadequate purge vacuum performance or collapse of the dryer membrane tubes resulting in poor drying performance and/or high sample gas flow restriction.

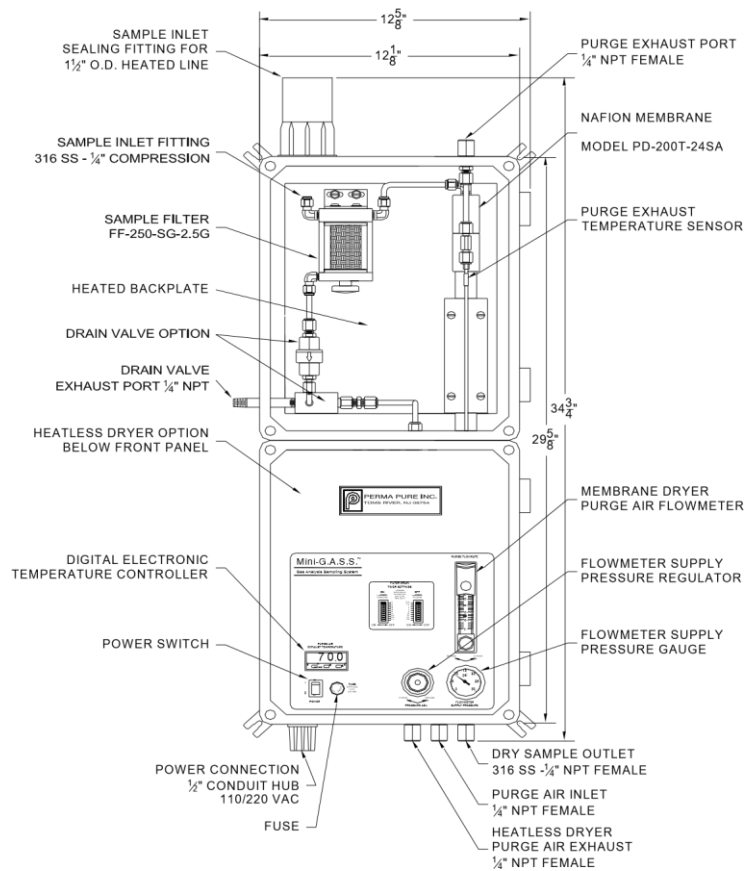


Figure 3 - Mini-GASS Sampling System

## **Filter drain**

**Failure to connect the drain properly may result in personal injury and/or property damage!**

The condensate and sample gas exhausted during draining of the coalescing filter can be hazardous and must be permanently routed to a drainage system designed to accept the type of discharge that is expected based on the composition of the gas sampled at the particular installation.

Connect tubing or pipe of an appropriate material from the drain outlet to a permanent drainage system designed for this type of discharge.

1. For vacuum style drains:  
1/4" I.D. tubing can be used for runs up to 10 feet. Use larger I.D. tubing for longer exhaust lines. Too small of an ID and/or too long of a piping run will cause inadequate drain performance.
2. For pressure style drains:  
Tubing with an ID of at least 1/8" is adequate.  
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.

## **Purge eductor inlet connection (optional)**

Connect air supply line to compression fitting labeled "Instrument Air".

## **Steam connection (optional)**

(Refer to figure 4)

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.

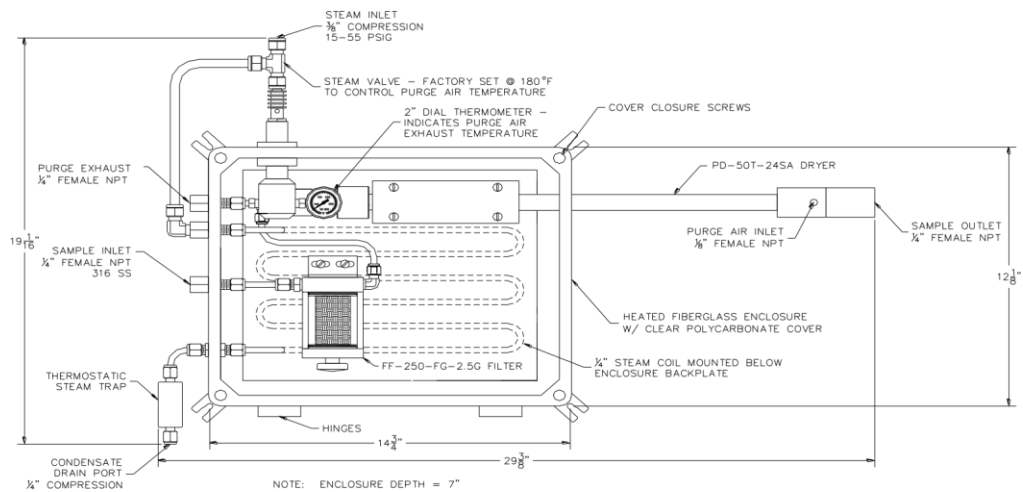


Figure 4 - Steam heated Mini-GASS

## Electrical connections

Mini-GASS Model #1228 and 2812T (Transportable) have a power cord and plug for 115 VAC and power cord with pigtail wires for the 230 VAC version. See Figure 5.

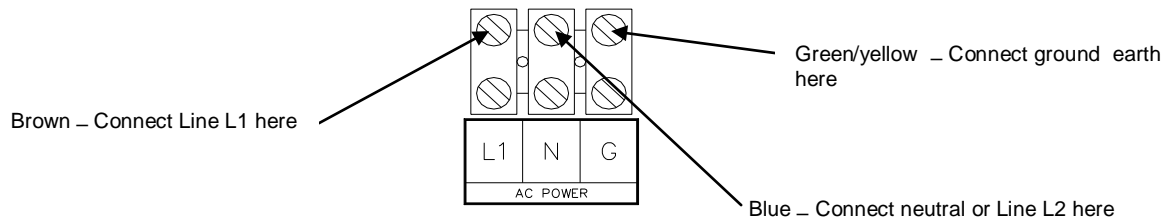
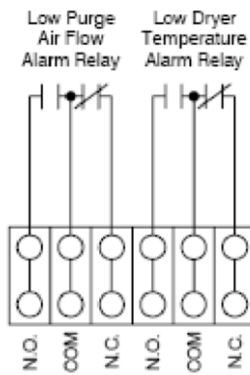


Figure 5 - Electrical Connections

## Alarm Relays

The alarm relay connection are made via 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. See Appendix F for additional information.



6 - Alarm Relays

Figure

### **Note-External Sample pump connection/operation**

If an external sample pump is used *with the sample pump plumbed downstream (after) the MiniGASS*, the optional purge eductor may be necessary, and is recommended for proper operation. This assumes that the sample gas stream is under a negative pressure. If needed the purge eductor vacuum regulator setting should be set so that the gauge indicates 5"Hg.

The purge eductor is used to balance the pressure difference between the sample gas stream pressure and the purge air pressure inside the Nafion Dryer. If a vacuum is drawn on the sample stream without additional vacuum on the purge gas, the difference in pressure may collapse the Nafion Dryer tubes. Warning: This situation will likely result in premature failure of the Nafion Dryer.

If an external sample pump is used upstream (before) the MiniGASS there will likely be additional maintenance required for the pump due to presence of potentially corrosive, wet gas. The purge gas eductor is not necessary in this situation, because the sample exiting the sample pump will be at a positive pressure.

### **Start-up procedure**

#### **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.

#### **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.**

<b>Drain Time</b> (left DIP switch)	0.1 minutes (1 <sup>st</sup> switch on – all others off) To 102.3 minutes (all switches on)
<b>Cycle Time</b> (right DIP switch)	1 hour (1 <sup>st</sup> switch on – all others off) To 1023 hours (all switches on)

1. Adjust purge air pressure regulator to about 15 psig. Purge regulator also supplies compressed air for filter drain, if equipped.

**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 adjustments after system has been in operation.

## **Temperature Control**

### **PID Electronic Temperature Controller**

1. Press and hold "★" key on the CAL Controls temperature controller.
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, 2812T systems have a low temperature alarm that is programmed into controller. Default temperature setting for alarm is 5° C below setpoint temperature. Refer to CAL Controls temperature controller manual for more information.

### **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° F which is the approximate temperature of the purge air exhaust indicated by analog thermometer located in the purge air exhaust stream.

### **Safety Interlocks**

Systems equipped with safety interlocks which controls the sample pump 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 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. See Appendix F for additional information.

## **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. The temperature controller will be alternately displaying **-AL-** and actual purge air exhaust temperature until purge air temperature comes within 5° 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.

## **System fine tuning**

### **Temperature adjustment**

#### **Steam heated systems**

Steam control valve is factory set to 180° 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.

#### **Electrically heated systems**

1. Temperature set point should be set to 5°C above sample gas stream temperature.
2. Check that no condensate is present in sample line between filter and dryer.
3. If water droplets are visible, increase temperature of filter/dryer compartment by 5° C.

4. Allow about ½ hour for system to stabilize and then check again for condensate.
5. If necessary, continue to increase temperature in 5° C increments 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.***

## **Maintenance**

If the sample gas is hazardous, care should be taken when opening the enclosure. Small leaks can allow the sample gas to build in the enclosure and take appropriate precautions, including PPE suitable for handling the sample gas and appropriate ventilation to prevent unsafe concentrations of gas.

### **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 7)

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.

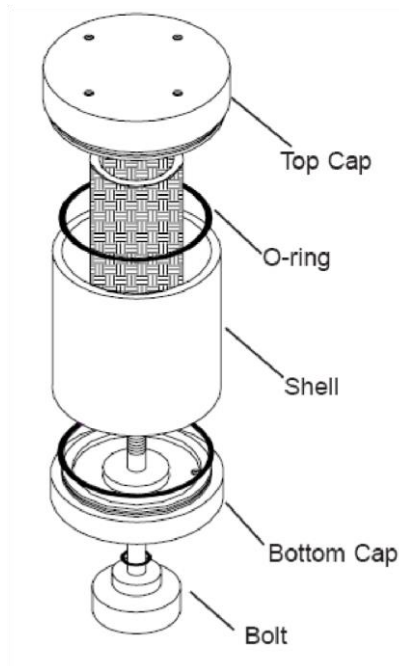


Figure 7 – Filter

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### **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.

### **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 over tighten**).



## **Fuse**

### Fuse Replacement

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

**Hint:** If system has blown two fuses, service is most likely needed by qualified personnel.

### **Replacement parts**

MG-PR	Purge Air Regulator
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 lpm)
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)

#### **For Dryers with two part end fittings**

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

#### **For Dryers with one part end fittings**

PD-50T-24E-M	50 tube dryer replacement element, 24" long, includes O-rings
PD-100T-24E-M	100 tube dryer replacement element, 24" long, includes O-rings
PD-200T-24E-M	200 tube dryer replacement element, 24" long, includes O-rings
FF-250-E-2.5G	Replacement filter element
FF-350G	Replacement glass shell for filter
FF-250-3	Replacement O-ring set, set of 3 rings
AS-200-08-EB	Media replacement for ammonia scrubber, bulk supply, 5 fillings
MG-PUMPKIT	Pump repair kit, Teflon diaphragm
3FEC-002	Ceramic filter element for MG-1228P

## **APPENDIX A: Warranty and disclaimers**

### **Perma Pure LLC**

Perma Pure (Seller) warrants that product supplied hereunder shall, at the time of delivery to Buyer, conform to the published specifications of Seller and be free from defects in material and workmanship under normal use and service. Seller's sole obligation and liability under this warranty is limited to the repair or replacement at its factory, at Seller's option, of any such product which proves defective within one year after the date of original shipment from seller's factory (or for a normal usable lifetime if the product is a disposable or expendable item) and is found to be defective in material or workmanship by Seller's inspection.

Buyer agrees that (1) any technical advice, information, suggestions, or recommendations given to Buyer by Seller or any representative of Seller with respect to the product or the suitability or desirability of the product for an particular use or application are based solely on the general knowledge of Seller, are intended for information guidance only, and do not constitute any representation or warranty by Seller that the product shall in fact be suitable or desirable for any particular use or application; (2) Buyer takes sole responsibility for the use and applications to which the product is put and Buyer shall conduct all testing and analysis necessary to validate the use and application to which Buyer puts the product for which Buyer may recommend the use or application of the product by others; and (3) the characteristics, specifications, and/or properties of the product may be affected by the processing, treatment, handling, and/or manufacturing of the product by Buyer or others and Seller takes no responsibility for the nature or consequence of such operations or as to the suitability of the product for the purposes intended to be used by Buyer or others after being subjected to such operations.

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## **APPENDIX B: Dryer element replacement**

### **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 8).
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.

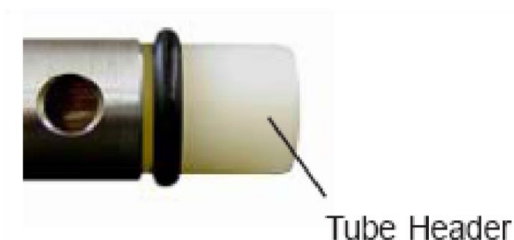


Figure 8

## TO ASSEMBLE DRYER (Refer to Figure 10)

Tool Needed:

- Phillips head screwdriver

1. Install one thick o-ring onto grooved tube header.
2. Slip opposite tube header into dryer shell. Check for Alignment.
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 9).
7. Tighten locking screws until underside of screw head contacts top of boss.
8. Repeat steps 4-7 for opposite end.



Figure 9

PARTS LIST		
ITEM	QUANTITY	DESCRIPTION
1	2	SCREW, 10-24 x 3/8" SS
2	2	COUPLING
3	2	ELEMENT HEADER SEAL, VITON
4	2	SHELL TUBE SEAL, VITON
5	1	DRYER ELEMENT
6	1	SHELL TUBE

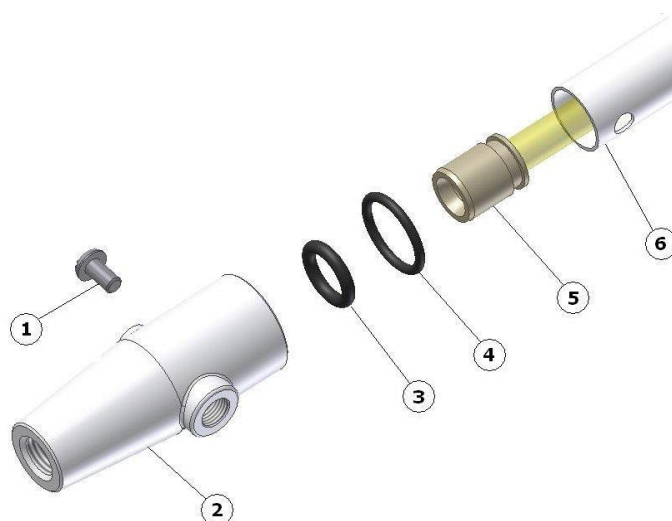
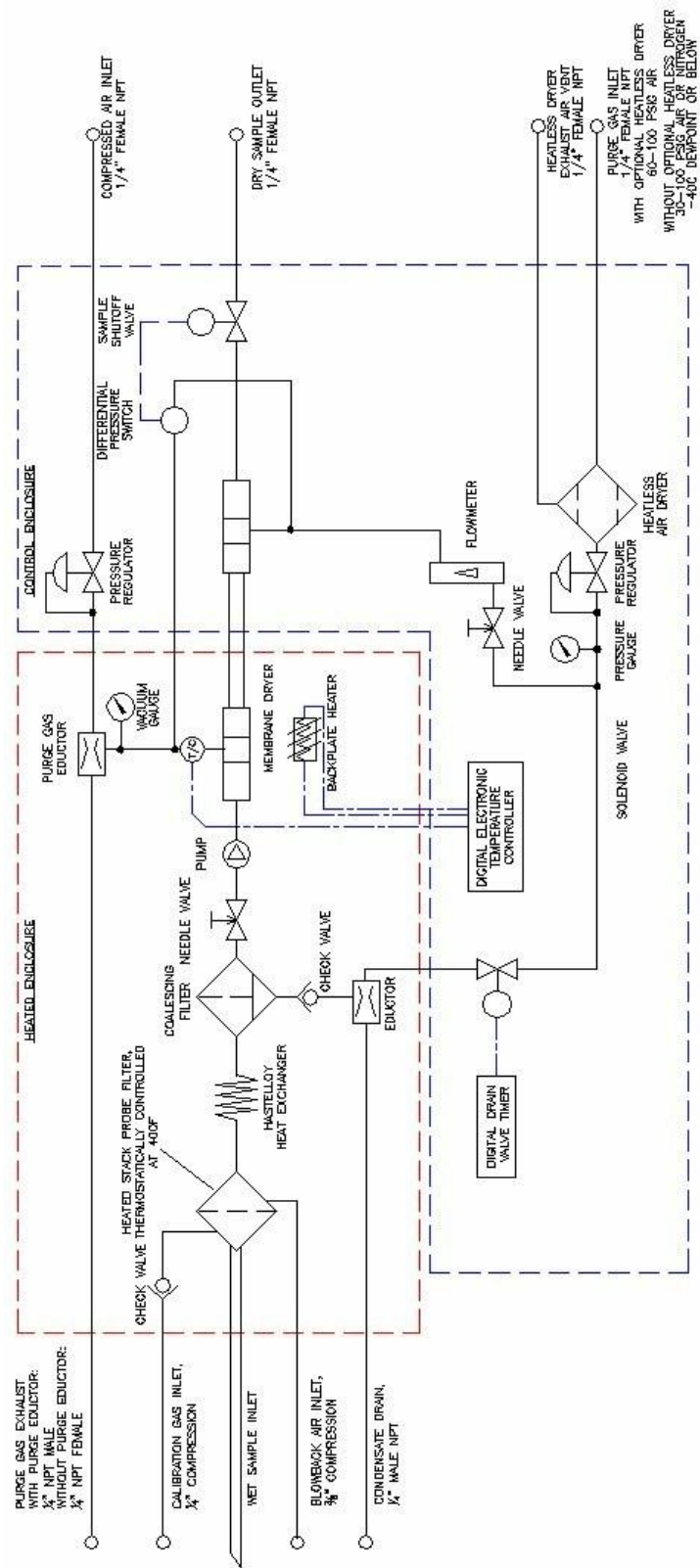


Figure 10

## **APPENDIX C: Diagrams**



## Piping and Instrumentation Diagram



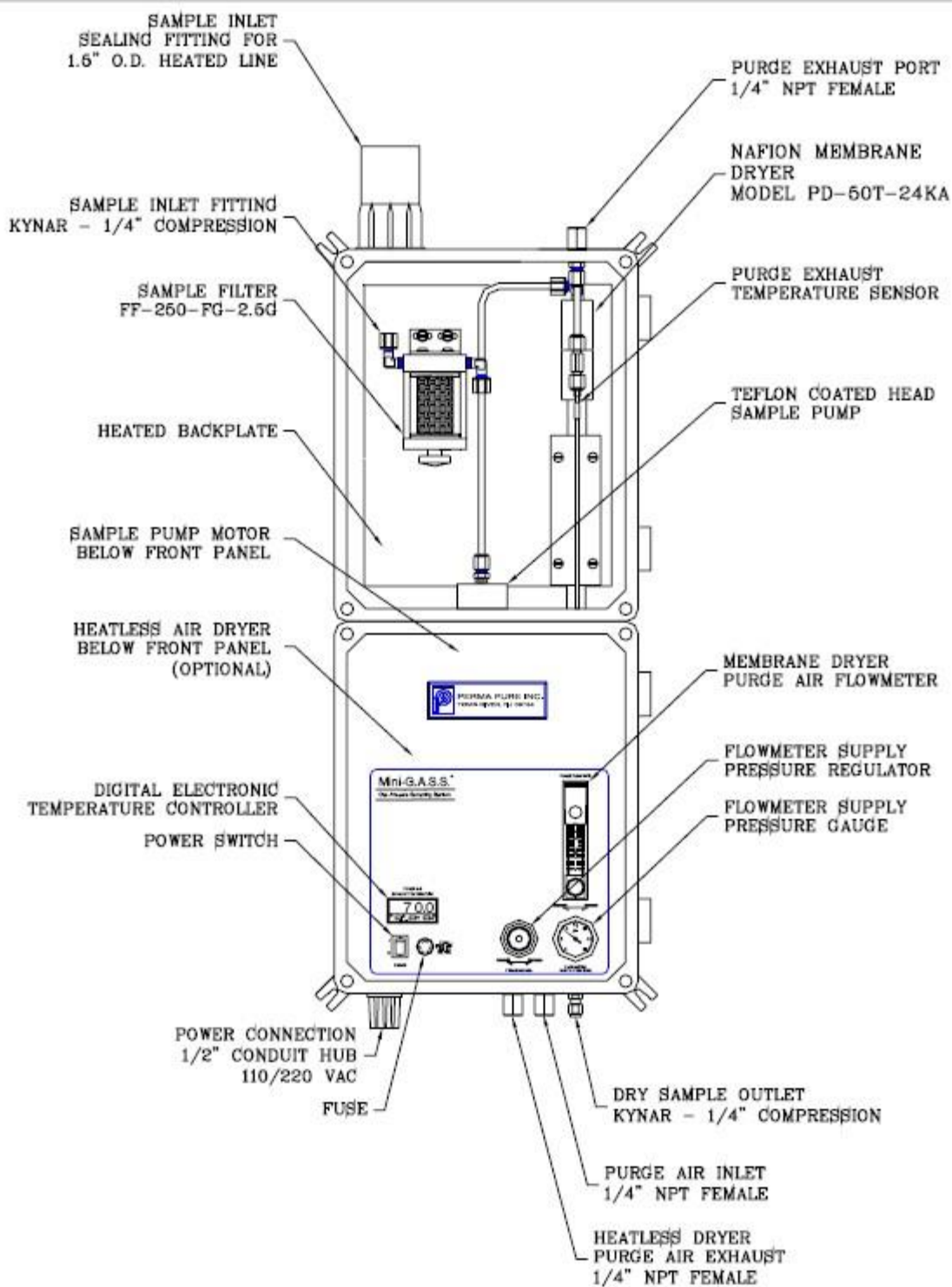


Figure 15  
MG-1228 Style System



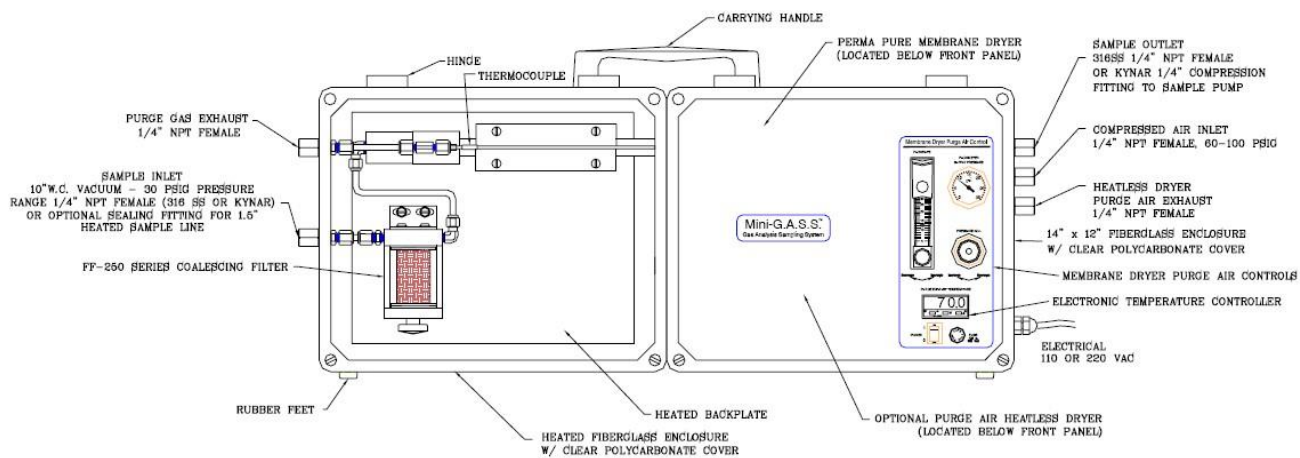


Figure 17 MG-2812T Transportable System

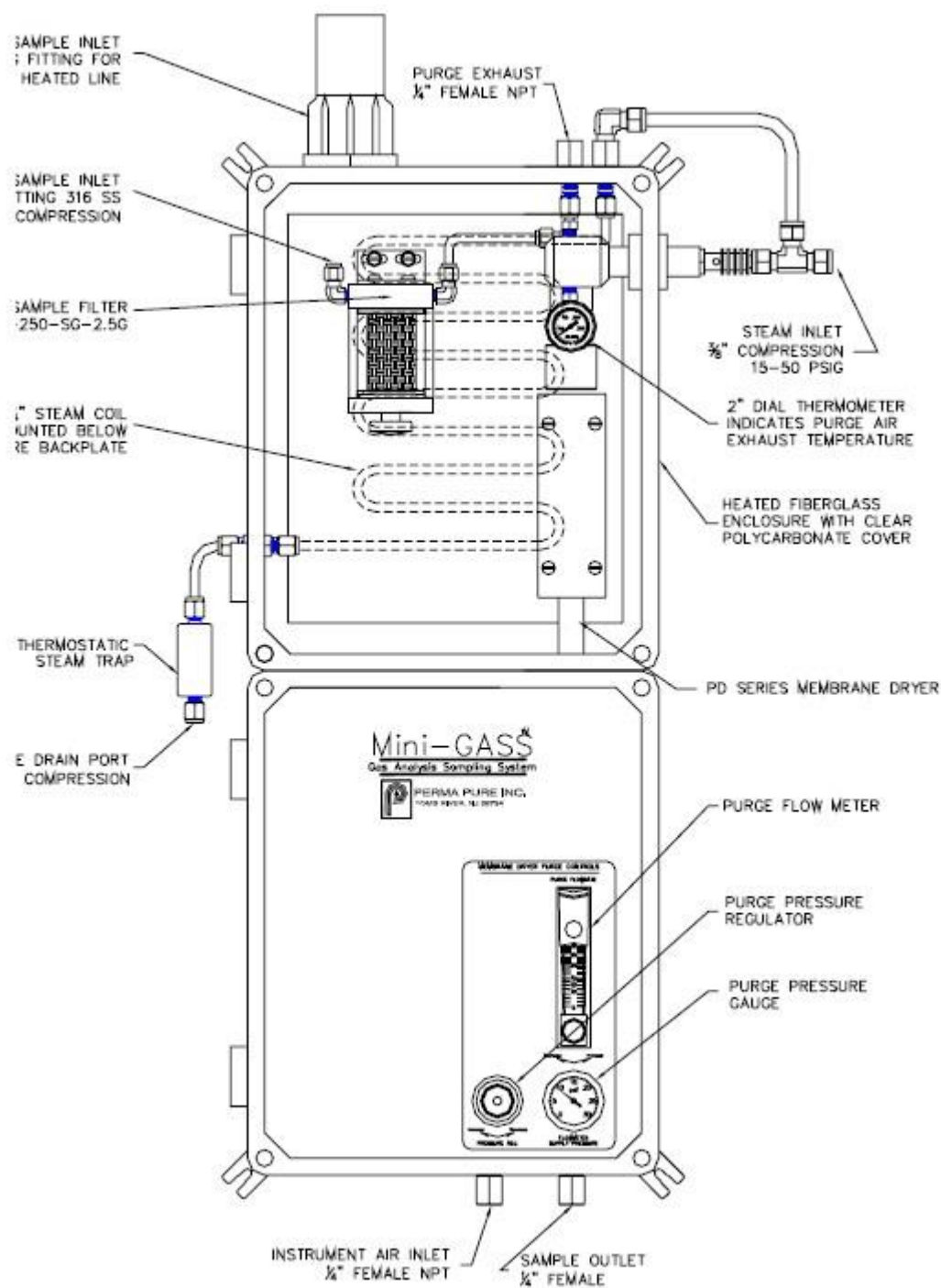


Figure 18  
MG 1228 Steam System

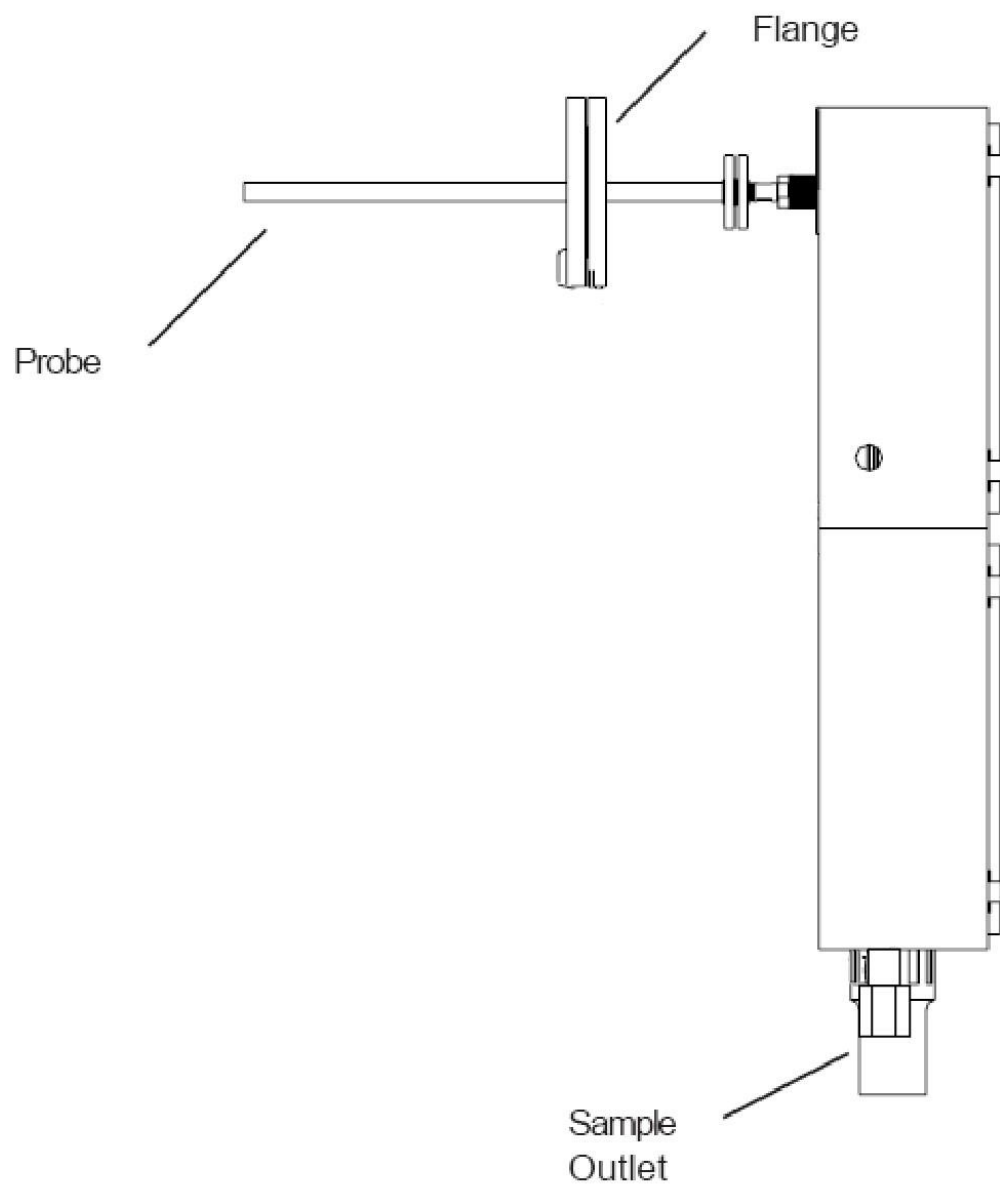


Figure 19  
MG-1228 with Probe

## **APPENDIX E: Z-Purge Operation**

With the inert gas supply connected, enclosure power de-energized 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.

### **Z-Purge Troubleshooting**

<b>Problem or Fault</b>	<b>Possible Causes</b>	<b>Corrective Action</b>
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.	In sufficient enclosure leakage or opening of the venturi orifice is crimped too small.	Remove the orifice, cut off crimped end and ream tube, then re-crimp 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.

### **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.

## **APPENDIX F: Safety Interlock System**

### **Control system safety interlock**

The interlock system is present to provide an output signal that can be used internally to stop sample flow via the sample isolation valve or optional internal sample pump. This system can also be used to provide an external output to a PLC or other control/monitoring system so that the status of the Mini-GASS can be monitored.

Two relays are used to perform this function:

- Low purge flow relay - A differential pressure switch across the purge air ports of the PD dryer senses the flow of purge air and energizes this relay when flow is present. A minimum purge flow rate of about 10 lpm is required. Below this flow, the alarm relay will de-energize.
- Low temperature relay – The CAL 3300 temperature controller has an alarm function that is used to energize this relay when the system is operating at normal temperature. The actual point at which a low temperature alarm is triggered is Set-point minus 5C. For instance, if the temperature controller is set at 90C, the alarm relay will de-energize at 85C.

The interlock system is used in the Mini-GASS to control the sample gas isolation valve or optional internal sample pump by simply supplying power to the interlock valve coil or sample pump motor via the alarm relays. Each of the relays is of a DPDT or double pole double throw design. This just means that there are two sets of normally open/normally closed (N.O./N.C.) contacts in each relay. One set of contacts is used internally and one set of contacts is provided to allow connection to an external system.

- Refer the drawing MG-1228-04-12. Internally these relays are wired in series to supply power to the sample isolation valve or sample pump. To accomplish this, switched line voltage (115,230VAC, Orange wire) is supplied to the common (term. #5) connection of the low purge flow relay. From the normally open (term. 3) connection of the low purge flow relay, a brown wire connects to the common (term. #3) connection of the low temperature relay. From the normally open (term. #3) connection of the low temperature relay, a gray wire connects to the sample isolation valve or sample pump. This allows the valve to open or the pump to start only if both relays are energized.
- Refer to Figure 20. For external connection, the second set of contacts in each relay is “dry”. No power is applied. This allows the user to determine the control voltage that will be used. A typical use of the alarm signal, as described above, is to control sample flow. The actual use is left up to the customer.

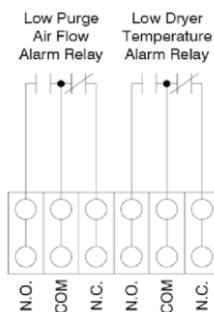


Figure 20