

Baldwin™-Series
Model M5A
Tester's Choice Portable
Sample Conditioning System
User's Manual



PERMA PURE LLC

A HALMA COMPANY

8 Executive Drive • Toms River, NJ 08755

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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 the transportation process, damage can occur by the carrier. This is out of control of Perma Pure 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 deliver. ***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.

Items in the carton include:

- (1) Model M5A – Testers' Choice Portable Sample Conditioning System
- (1) Power cord
- (1) User's manual

If any of the above parts are missing or damaged, call the helpline at **(800) 337-3762**.

Introduction

Thank you for purchasing this product from Perma Pure LLC. This manual has been assembled so that it can answer all questions regarding operation. Please keep the operators manual near the equipment for future reference. There may also be optional equipment available that was not ordered at the time of original purchase, which may be described and/or illustrated in this manual.

If you still have any questions regarding your equipment's operation, available options or technical support, please contact your purchasing dealer or contact Perma Pure directly.

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The Testers Choice Portable Sample Conditioning System can be either used for intermittent or continuous operation. It is designed for accurate, repeatable and precise gas sample conditioning that can be effectively carried out nearly anyplace and at anytime. This unit is also designed to require only a minimum amount of maintenance to maximize its operation.

General description

The Perma Pure/Baldwin Tester's Choice Model M5A Thermo-Electric cooler features a complete gas conditioning system in one easy to manage enclosure. The unique design leaves additional space to install or access other sample conditioning system components. A unique drop-down door on the M5A cooler section, provides easy access to electronic boards and the power supply. All electronic boards (control, relay, and display) are mounted on the door of the cooler for easy access. Sample pump and peristaltic drain pump(s) are also mounted within the enclosure.

The process of sampling combustion product stack gas or exhaust from internal combustion engines requires a method to remove the moisture from the sample, without removing the gas components of interest. The Tester's Choice M5A System is an ideal way to decrease the dew point of combustion gases to a repeatable, stable, constant low dew point. The Tester's Choice M5A system prevents water condensation in sample pre-filters, sample pumps, and gas analyzers. For gas analyzers where water vapor is an interferent, a stable, repeatable, dew point, becomes a part of the gas analyzer performance specification. The Tester's Choice system provides this constant low water concentration, resulting in an accurate component gas measurement.

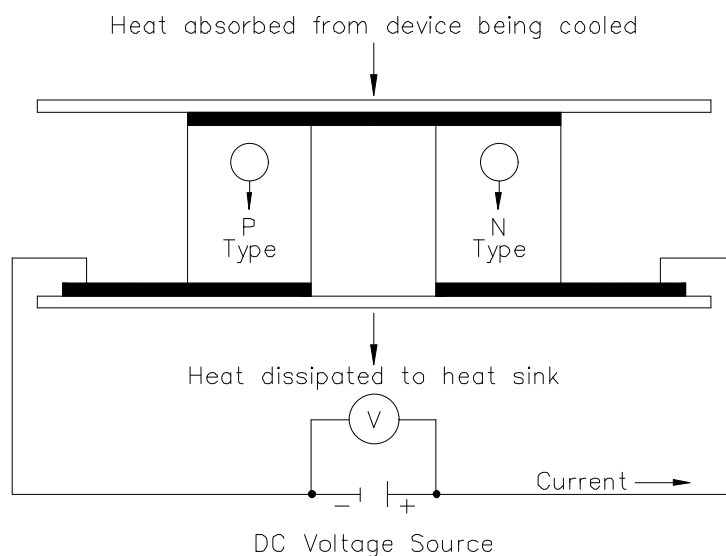


Figure 1: Thermo-electric element (Peltier)

The Tester's Choice M5A system removes the moisture from the sample gas by cooling the gas as it passes through a laminar impinger (heat exchanger). A diagram showing the gas flow path through an impinger is shown in the Appendix B2. The impinger, made of 316L stainless steel, Durinert® (a corrosion-resistant inert coating over 316L stainless steel), PVDF (Kynar®), or glass, is mounted within a thermally insulated heat transfer block bored to receive the impinger without a mechanical lock. This assembly allows the easy removal of any impinger simply by slipping it out of the cooling block by hand. The heat transfer block cools the heat exchanger through the heat pumping action of the Peltier element. The heat transfer block is on the cold side of the thermo-electric element and the heat sink is on the hot side of the thermo-electric element. The desired temperature is maintained by a closed loop control system, which is implemented through an analog proportional controller. The controller uses a type K thermocouple as a sensor.

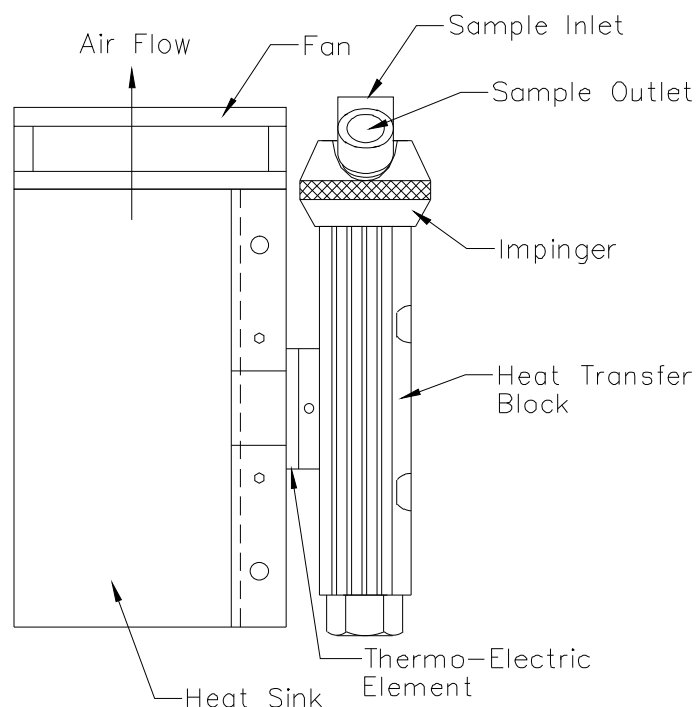


Figure 2: Heat Exchanger, Impinger and Heat Sink

The Tester's Choice M5A system will reduce the sample gas dew point to 5°C at a maximum flow of 8 Liters Per Minute (LPM). This is slightly above the temperature that the condensate removed from the gas stream will freeze. If the condensate freezes sample analysis and gas stream flow will be compromised.

If a lower dew point is necessary, a Perma Pure LLC Supplemental Drying System (S.D.S.) may be necessary. A sample gas stream that contains significant amounts of SO₃ may also be encountered. Perma Pure LLC/Baldwin can supply SO₃ Aerosol Removal Systems, specifically for this purpose.

Please contact Perma Pure LLC for suggestions on alternative devices. Perma Pure LLC has a system and expertise that can handle nearly any sample conditioning application.

Physical Description

- Single channel system
- 2 x 10" heat exchangers connected in series only
- 1 Active (cooled to 5°C) heat exchanger
- 1 Passive heat exchanger
- LCD temperature display and LED status indicators
- Dimensions: 14.5" x 11" x 10.5" HWD (37 x 28 x 26.5 cm)
- Weight: 53 lbs (24 kg)

Specifications

Sample gas flow range	Up to 8 LPM (17 scfh)
Water content	20% H ₂ O (60°C DP) @ 5 LPM
Maximum cooling rate	440 BTU/ht (464 kJ/hr)
Maximum inlet sample temp.	400°F (205°C) for SS or glass impingers 280°F (138°C) for Kynar™ impingers
Maximum inlet pressure	15 psig (1 bar)
Maximum pressure drop	<+1 in H ₂ O
Ambient temperature range	33-114°F (0.6-43°C)
Outlet sample gas dew point	41°F (5°C)
Voltage	115VAC (230VAC optional) 50/60 Hz
Power supply	1000W
Cooling down time	Less than 10 minutes

Connections

- Sample gas inlet: Stainless Steel, 1/4" tube compression fitting
- Sample gas outlet: Stainless Steel, 1/4" tube compression fitting
- Drain tubing connection: Kynar, 1/4" barbed tube fitting

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.

- **NEVER** attempt to operate this equipment in an explosive or otherwise hazardous area.
- **NEVER** exceed any specified rating for the equipment. Voltage, temperature and pressure ratings must be closely observed and not exceeded. Voltage rating of the equipment **MUST** match the rating on the data label. Please make sure that it matches before powering up the equipment.
- This equipment is **NOT** designed to be used in an explosive environment.
- This equipment is **NOT** designed to operate in a wet environment.
- **Condensate is potentially dangerous. Never** handle drain lines, impingers 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 this equipment.
- **NEVER** replace fuses with types other than the same specification of type and current. Do not bypass this, or any, 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 LLC dealer or directly from Perma Pure LLC 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 Testers Choice Portable Sample Conditioning System.
 - Verify that the unit is connected to the proper rated power for the system
 - Verify that the unit is plumbed properly to operate effectively
 - Do not block either the cooling air inlet or outlet on the rear of the cabinet. The efficiency of the unit will be compromised and long term use in this condition could permanently damage the cooling system.

Connection & Start-up

The Classic Tester's Choice portable sample conditioning system should be set up away from any heat sources in a well vented area.

The system can only be operated in an upright position. The conditioning system must not be set up at an angle greater than 30° from vertical.

NOTE: The operational stability of the cooler dew point is influenced by the stability of the ambient temperature.

For proper operation, the ambient temperature cannot exceed 43°C (110°F). At, or close to the maximum ambient temperature, the cooler will not be able to control the temperature to reduce the dew point of the sample gas to the 5°C set point. This will result in compromised operation and water slip or carryover, possibly into the analyzer.

The Tester's Choice portable sample conditioning system can be either used for intermittent or continuous operation. It is designed for accurate, repeatable and precise gas sample conditioning that can be effectively carried out nearly anyplace and at anytime. This unit is also designed to require only a minimum amount of maintenance to maximize its operation.

Sample and Drain Connections

1. Connect a suitable condensate drain line to the connector on bottom of unit.
NOTE: Do not reduce the size of the condensate tubing since doing so restricts water flow resulting in water carryover into the sample.
2. Run the external drain line to appropriate drain receptacle.
Drain condensate can be potentially hazardous. Always make sure that proper precautions are taken regarding personal protective equipment when handling condensate.
3. Connect the sample line to the stainless steel sample inlet compression fittings on the rear of the unit. See figure 3.
NOTE: If using stainless steel sample line, place 2 inches of Teflon tubing in between the exchanger inlet fitting and the heated line. This prevents the sample cooler from heat sinking the incoming heated line, which adds undue load to the cooler.



Figure 3 - Gas connections



The Tester's Choice M5A will condition a single gas stream in its standard configuration only. A second, parallel gas stream connection and the associated hardware are available as an option. If this option was purchased, see Appendix D for instructions.

4. Connect the conditioned sample outlet connector to the sample gas line leading to the analyzer.
5. Connect the supplied power cord to the receptacle on the rear of the unit. See figure 4.



Figure 4 - Power connection

Do not power up the unit at this time. Verify that the proper supply voltage is available to power the Tester's Choice M5A.

LED Summary

The controls for the M5A cooler are visible through the main door's window. The M5A can flow up to 8 LPM of a gas stream, reducing the dew point to 5°C or less. There are several indicators and a display to provide operational information on the status of the cooler. The temperature of the active channel can be viewed on the LCD display.



Figure 5 - Front display panel

There are a set (for the active channel) of 3 LED status displays, 1 red and 2 green. These indicators are arranged vertically on the front of the cooler. See figure 5.

- "Failure" Red LED comes on if the thermocouple or an electronic controller component has failed.
- "Slip" Green LED comes on when powered up.
- "Ready" Green LED comes on when the ready set-point temperature (+10°C) is reached.

NOTE: "Slip" LED is connected to the water slip sensor, which is normally dry on start up. If the "Slip" Green LED goes out, this indicates water is "slipping" past the heat exchanger. The relay then shuts off the sample pump so that water is not allowed to reach the analyzers, preventing damage to the analytical instruments. Steps need to be taken at this time to determine the cause of the moisture and correct the situation.

The sample pump will begin operating once the green **READY** indicators are both lit.



Start-up

The gas sample pump is controlled and will operate only under certain conditions. The sample pump will only be allowed to run if the temperature is 10°C or less AND the water slip sensor indicators are green.

The peristaltic drain pumps will run continuously anytime Tester's Choice is energized.

Now that there is a complete understanding of all of the controls and indicators, please verify that all of the connections to the Testers Choice M5A are correct. Once this re-check has been completed, please energize The Testers Choice M5A. The unit should be ready to operate and begin the sample conditioning process after operating for about ten minutes.

1. Plug power cord into a properly grounded main circuit. Green "Slip" LED will come on.
2. Wait for the green "Ready" LED light to come on, approx. 3 minutes. This will indicate the ready temperature (+10°C) has been achieved and the sample gas flow can begin.
3. After approx. 3 more minutes, the factory set-point of +5°C (41°F) or less will be reached.

The SLIP Green LED is always on unless;

- Moisture is detected by the water slip sensor
- The cooler was ordered without a relay board
- There is a malfunction (e.g. Shorted water slip sensor leads or a bad relay board)

Shutdown

After completion of operation with a gas stream, allow the Testers Choice to run for at least 10 minutes with both **Sample In** and **Sample Out** connections open to atmosphere. This will allow the inlet and outlet lines a sufficient amount of time to evacuate any moisture in the system. If an overly high dew point sample was introduced to the system it may be beneficial to allow the system to run longer. In any case it is always a good practice to make sure that all of the condensate is drained from the impingers, drain lines and peristaltic pumps. Visually observing the condensate drain, while the peristaltic pumps are running, is good practice to ensure that condensate is completely removed from the system. This should be done before disconnecting the drain hose from the system.

Condensate is potentially dangerous. **Never** handle drain lines, impingers 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.

After the Testers Choice M8 has been run for a period of time, it is possible that a small amount of clean water may puddle in the bottom of the cabinet. This moisture is a byproduct of the thermo-electric coolers operation and may come from the cooling block assembly's outer surface. The surface temperature of the cooling block, which has gone below the ambient air dew point, may cause condensation to drip to the bottom of the cabinet. This is a normal situation, but doesn't always occur. Any water inside of the cabinet should be removed before transporting the unit to a different location.



Troubleshooting and Maintenance Guide

Symptom	Diagnostic	Fix
No LED(s) and no fan.	AC power input.	Ensure that AC power is connected.
No LED(s) and fan on.	AC input fuse on control board. DC output fuse on control board.	Replace fuse as necessary. Replace fuse as necessary.
LED(s) on and no fan.	AC input fuse on power supply. +15vdc TB4 on control board.	Replace fuse as necessary. If not present, replace power supply.
Impinger remains at ambient temperature.	Peltier current draw. Should be above 6 amps when first turned on. If unit has two active impingers, switch Peltier element connections to other channel	If lower than 6 amps or above 8 amps suspect that Peltier element has failed. If problem remains at same channel, control board defective. If it changes, Peltier defective
Thermocouple failure LED is on.	Thermocouple connection TB1, 2.	Ensure proper connection to control board. If connection good, replace thermocouple.
Impinger frozen and cooler indicates ambient temperature.	Thermocouple placement in heat exchanger block.	Ensure proper placement. Replace thermocouple or control board.
Impinger does not reach set temperature, but is below ready temperature.	System loading. Calibration and Set temperature adjustment.	Ensure system loading is not exceeding cooler capacity. Consult with Perma Pure Tech Support
Impinger temperature cycles up and down.	Peltier connections on control board.	Ensure a firm connection on flag connectors on control board. Ensure system loading is not exceeding cooler capacity.
Ready LED does not come on when impinger is below 7°C.	Ready temperature adjustment.	Consult with Perma Pure Tech Support.
Water Slip (carryover) in system.	Impinger temperature. Should be below 6°C.	Ensure system loading is not exceeding cooler capacity. Ambient must not exceed 45°C (113°F)
Slip LED does not come on (<i>alarm relay/water slip option installed</i>).	Water slip sensor connections.	Ensure that all water slip sensor connections are made. Clean tip of sensor. Replace alarm relay/water slip board as needed.

Sample pump does not start. Ready and slip LED(s) are on (<i>alarm relay/water slip option installed</i>).	Water carryover in system	Clean water slip sensor and restart. Ensure system loading does not cause water slip
	Ambient air temperature too high	Ambient must not exceed 43°C (110°F)
	Operation of peristaltic pump(s) or eductor	Verify that pump or eductor is draining condensate from impingers; Replace pump/hoses as necessary
	Heat sink cooling fan and heat sink air flow path	Fan and air path need to flow proper amount of air. If debris is clogging air path or fan is not functioning properly, unit will lose efficiency
	Air leaks in sample line	Verify that there are no air leaks at any point in the sample line. Ambient air entry either on the pressure or vacuum side of the sample pump will cause excess condensate and could lead to water slip.
Sample pump does not start. Ready LED is on; Slip LED is Off (<i>alarm relay/water slip option installed</i>).	Electrical connections to sample pump	Verify that proper voltage is reaching pump. If voltage is good, replace pump If voltage is not present, check for voltage at relay board; if not present consult with Perma Pure Tech Support. If voltage present trace out wiring issue.
Sample pump starts. No sample stream. Ready LED is on; Slip LED is ON (green) (<i>alarm relay/water slip option installed</i>).	Sample line connections	Verify proper connections.
	Verify that flow meter needle is not seated	Adjust as necessary
	Filter element	Check for clogged filter. Replace element if necessary.
	Sample line clogged or deformed	Unclog, reform/replace as necessary
	Sample pump suction/ pressure	Sample pump valve discs/gaskets/diaphragm have reached the end of service life. Replace as necessary. Consult with Perma Pure Tech Support



Replacement Parts

Part No.	Description
2FAN-007	Fan: muffin, 6" x 1-1/2", 12 VDC
2FAN-009	Fan: muffin, 3" x 2", 12 VDC
3CXD-022	Impinger: 10" EZ-clean twist-apart stainless steel Durinert®
3CXG-002	Impinger: 10" Glass, threaded w/ fittings
3CXK-003	Impinger: 10" Kynar
3CXS-022	Impinger: 10" Stainless steel, EZ-clean twist-apart
3KPE-004*	Peltier element Kit, 40 mm, single TE
3CCB-019*	Control board: dual channel
1PSD-009*	Power Supply: 500 W, 15 VDC
3CCB-018*	Alarm Board: Dual Channel
3TCB-002	Temperature control board, dual channel
1TTC-003	Thermocouple: Temperature, Control, Type K, 36"
3KFA-001	Complete filter assembly, sample in-line, 2-micron
3FHG-001	Filter bowl, glass
3FEC-002**	Filter element: ceramic, 2-micron
3KPB-003	Peristaltic pump: dual, kit, 115V complete w/ enclosure
3KPB-004	Peristaltic pump: dual, kit, 230V complete w/ enclosure
2PBM-003	Peristaltic pump: head only, standard
2PBM-001	Peristaltic pump: motor only, 115V AC 60 Hz
2PBM-006	Peristaltic pump: dual head, hardware Kit
2PBT-002PK*	Peristaltic pump: Tubing, Norprene, Size 17 (10 feet)
3KPA-002*	Sample pump: assembly, dual head w/ check valve, 115V
3KPA-005*	Sample pump: assembly, dual head w/ check valve, 230V
2PAM-002*	Sample pump: repair kit, dual head
3CWS-007	Water slip sensor only with 18" leads
3KCW-007	Water slip sensor (SS pins) w/ holder assembly, 1/4" Kynar fittings

* Recommended Spares **Consumables

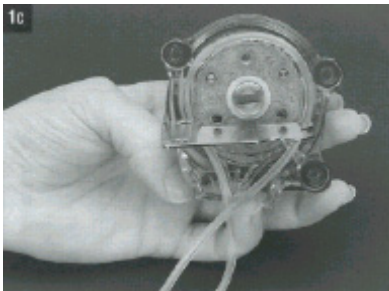
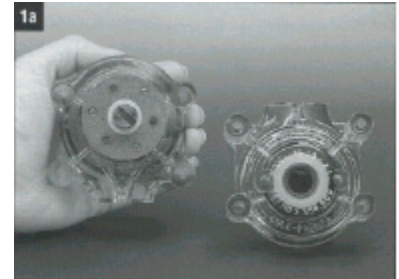
Appendix A: Installation of Peristaltic Pump

NOTE: Perma Pure peristaltic pumps are rated for a maximum pressure of 20 psi.

If supplied loading key is not available, use a flat head screwdriver.

Single pump head loading

- Separate the end bells (the pump head halves). Hold the end bell containing the rotor as shown with the tubing retainer grooves facing down.
- Place tubing in the right groove and against the first two rollers. Hold tubing with thumb. Near groove, insert smaller prong of loading key between the top of the rotor and tubing. Push key in as far as possible.
- Push down and turn key counterclockwise completely around the rotor. The key will push the tubing uniformly into the end bell assembly. Hold the second end of the tubing. Remove key.
- Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together, reload tubing. If necessary, turn key in slot on rotor shaft to adjust tubing (as in step e).
- With key in slot on rotor shaft, turn key to align tang on rotor shaft with slot in motor drive shaft. Point tubing retainer grooves up. Shift the pump head slightly till it snaps on the alignment pins (if present). Secure with four provided screws. Tighten with fingers only.



Multi-channel mounting

- Load the pump heads with tubing.
- Install the four correct length mounting screws in drive.
- Slide the first pump head into the mounting screws.
- Place key in slot on mounting shaft. Twist to align tang on rotor shaft with slot in motor drive shaft. Shift the pump housing around till it drops over the alignment pins (if present).
- Repeat for each additional pump head, aligning pump head tang with slot on previously mounted pump head.
- Slide the flow flat washers onto screws and secure with the four wingnuts. Tighten with fingers only.



Replacement parts

2PBM-001	Peristaltic pump, motor only, 115 VAC 60 Hz
2PBM-002	Peristaltic pump, motor only, 230 VAC 50 Hz
2PBM-003	Peristaltic pump, head only, standard
2PTB-002PK	Peristaltic pump, tubing, Norprene, size 17 (10 feet)
2PBM-006	Dual head hardware kit



Appendix B: Drawings

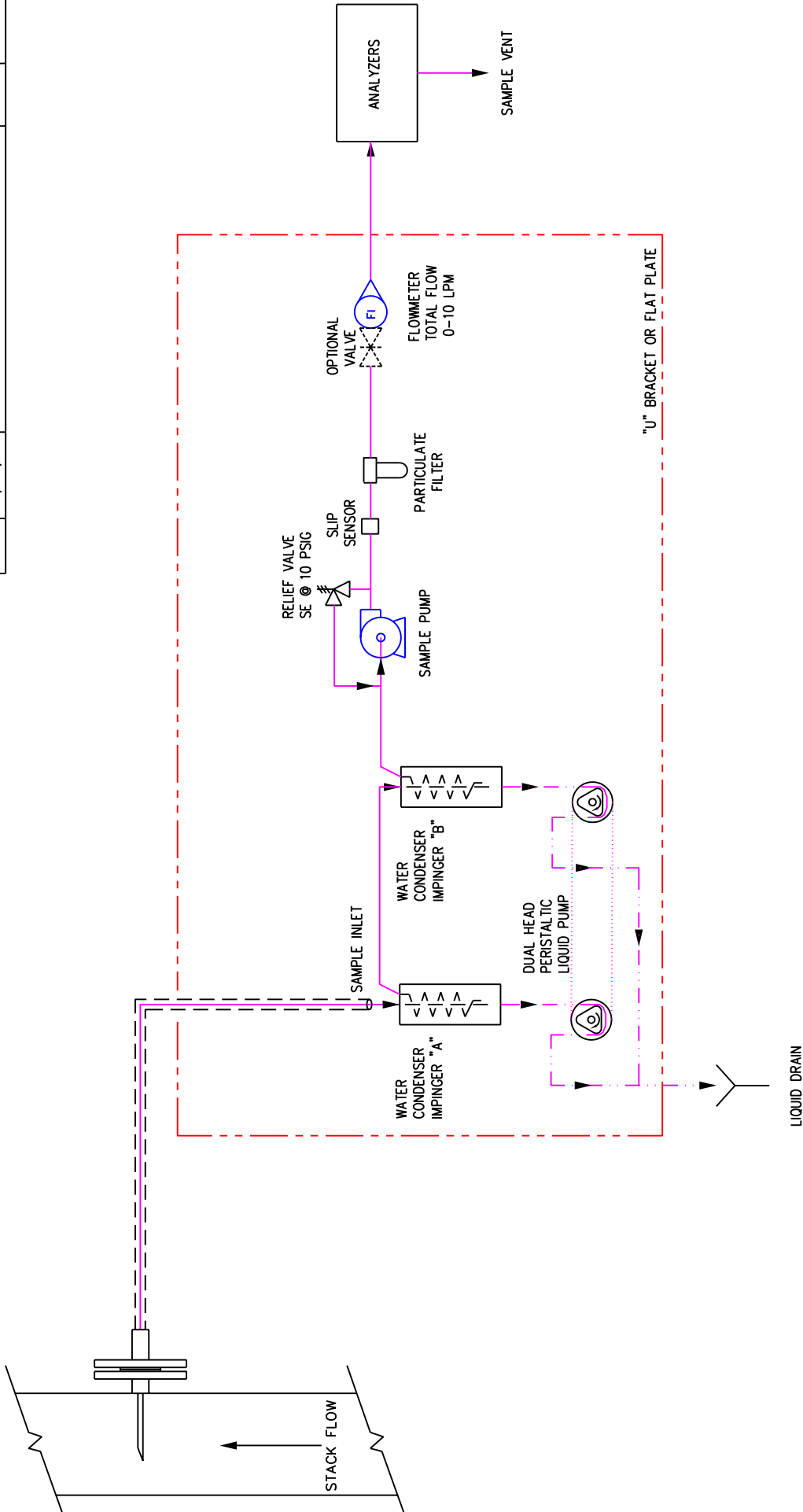
- B1: 4S-M5A flow diagram
- B2: Impinger schematic
- B3: Relay board contact state
- B4: Relay board field connections
- B5: Interconnect diagram

1

2

3

4



NOTES:

1. ALL COMPONENTS WETTED BY SAMPLE AND CALIBRATION GASES SHALL BE STAINLESS STEEL, BOROSILICATE GLASS, TEFLON OR VITON.
2. TOTAL FLOW SHALL BE RATED CAPACITY OF SAMPLE CHILLER.

ITEM	QTY	DESCRIPTION	MANUF.
------	-----	-------------	--------

USED FOR:	MODEL NUMBER: M325, 5210
DESCRIPTION:	

DATE	DATE
MES	
APPR:	
MATERIAL	
FINISH	
DESIGN DIMENSIONS ARE IN INCHES () DENOTES MILLIMETER EQUIVALENTS WHEN USED	
SIZE	SCALE:
A	NTS
PART DESCRIPTION	
PASSIVE/ACTIVE SAMPLE CONDITIONING SYSTEM FLOW DIA.	
DRAWING/PART NO.:	
A	PASSIVE/ACTIVE
CAD DIR: S:\\$B&M\DWGS\	S&M COND. SYSTEM DWG
SHEET 1	OF 1

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TOLERANCE UNLESS OTHERWISE SPECIFIED	DECIMALS
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3 PLACE = ± .010	ANGLES = ± 5°
Holes = ± .003/- .001	
BALDWIN	
www.baldwinUSA.com	

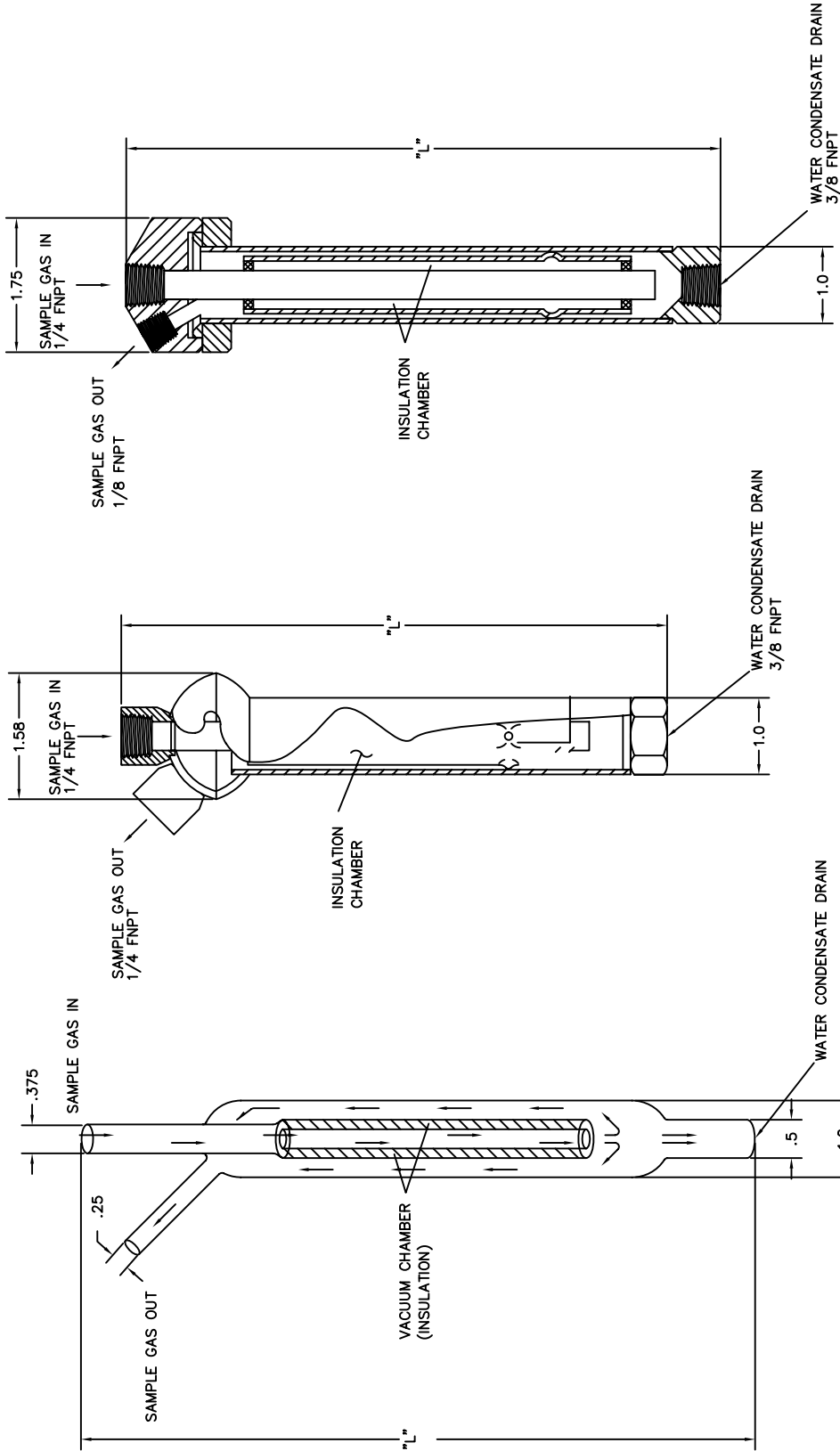
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REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	11/13/98	INITIAL DRAWING	MES	MES



KYNAR

STAINLESS STEEL &
DURINERT COATED

BOROSILICATE GLASS

NOTE:
INLET OF FIRST IMPINGER IS
3/8" FNPT.
INLET OF SECOND IMPINGER IS
1/4" FNPT.

LENGTH TABLE

	"L"
5" GLASS	9.0
10" GLASS	14.5
5" STAINLESS STEEL	7.0
10" STAINLESS STEEL	12.25
5" KYNAR	7.0
10" KYNAR	12.25

ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:		MODEL NUMBER: Heat Exchangers	
DESCRIPTION:			
DRAWN BY:	MES	DATE	11/13/98
APPR:		DATE	
MATERIAL			
FINISH			
DESIGN DIMENSIONS ARE IN INCHES () DENOTES MILLIMETER EQUIVALENTS WHEN USED			
SIZE	A	NTS	IC0060
DRAWING/PART NO.:			
PART DESCRIPTION			
HEAT EXCHANGER SCHEMATIC			
BALDWIN, INC.			

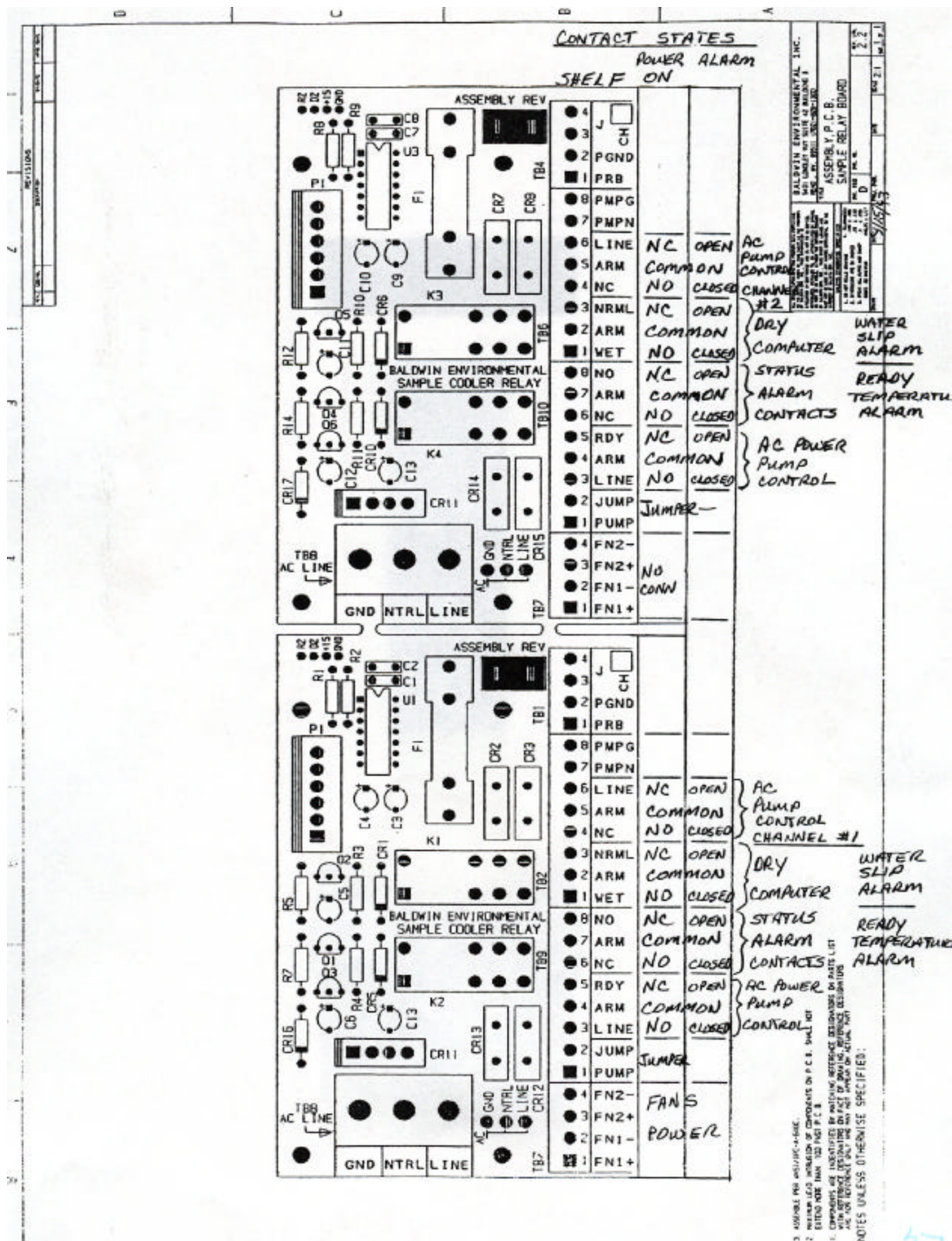
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2 PLACE = ±.02
3 PLACE = ±.010
ANGLES = ±5°
HOLES = +.003/- .001

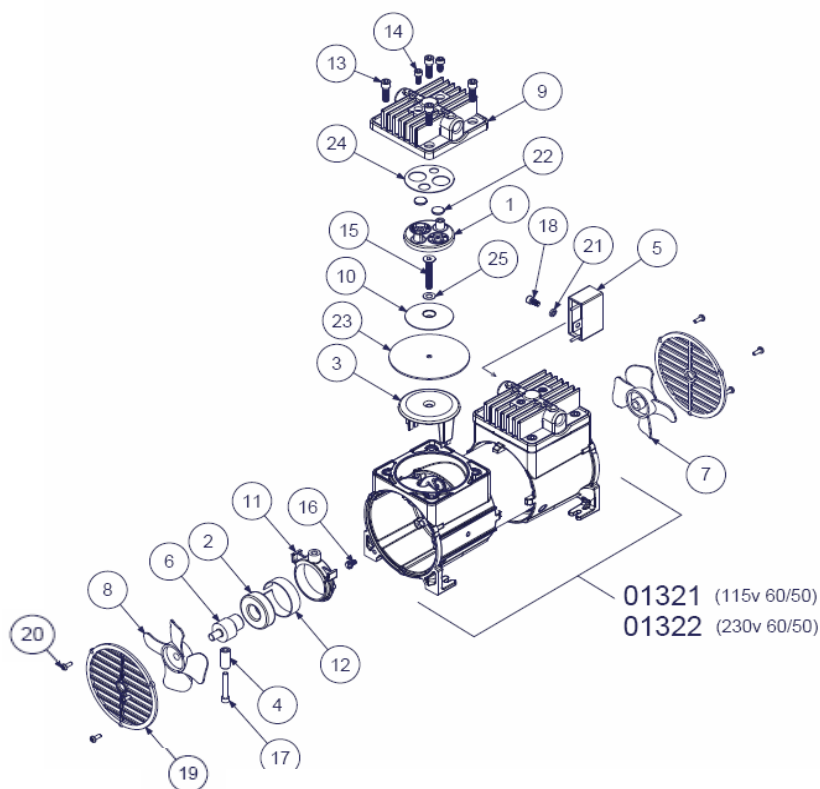
MAKES PROPOSED



Appendix C: Perma Pure Sample Pump Maintenance Instructions

Item #	Description
--------	-------------

- | | |
|----|-----------------|
| 1 | VALVEBODY |
| 2 | BEARING |
| 3 | CAP |
| 4 | CWEIGHT |
| 5 | CAPACITOR |
| 6 | ECCENTRIC |
| 7 | FAN, BLUE |
| 8 | FAN, WHITE |
| 9 | HEAD STD, SS |
| 10 | PLATE DIAPH. |
| 11 | CONNECTING ROD |
| 12 | TOL. RING |
| 13 | SCREW-HEAD/BASE |
| 14 | SCREW |
| 15 | PLATE SCREW |
| 16 | GROUND SCREW |
| 17 | SCREW |
| 18 | SCREW |
| 19 | SCREEN |
| 20 | SCREW |
| 21 | LOCK WASHER |
| 22 | DISC-VALVE |
| 23 | DIAPHRAGM |
| 24 | GASKET |
| 25 | WASHER |



Disassembly of head section and service diaphragm

1. Remove head section by unscrewing the four large bolts. A flat-bladed screw driver may be needed to gently pry the head free of the service diaphragm. If you have Teflon coating on the heads, use caution not to scratch the surface.
2. The valve body can then be removed by unscrewing the two smaller screws (also accessible on the top of the head section). This part may be freed by gently tapping on these two screws after they have been loosened about 3 or 4 turns. When the valve body is removed, check all internal surfaces for an accumulation of dirt. The two valve discs can be wiped clean and replaced as long as they appear unaffected by usage. The valve gasket can be easily removed and should be inspected. As a matter of good practice, the valve discs and valve gasket should be replaced during any routine maintenance check of the head section. A once a year routing procedure is recommended.
3. The service diaphragm is secured by the single screw in its center. Remove this screw with a 5/32" Allen wrench. The diaphragm and its clamping plate should be easily lifted off. Some slight adherence to the metal may occur if the diaphragm has been in use for a long period.
4. When replacing the service diaphragm, a Teflon washer should be inserted under the head of the diaphragm cap screw. This is added insurance against small gas leaks through screw heads and may be essential in vacuum applications where outside air contamination cannot be tolerated. After tightening the screw, the excess Teflon should be trimmed away.
5. NOTE: When replacing the service diaphragm, be sure the four projection studs of the base casting are properly located in the four outer holes provided in the diaphragm before the part is clamped in place. Be sure the diaphragm plate is firmly replaced with its center screw.

Replacement parts:

2PAM-002 Sample pump repair kit, dual head



Appendix D: Dual Stream Operation

The dual stream option was not purchased for this unit.

Appendix E: Conversion Tables

CHART OF VOLUME PERCENT WATER CONCENTRATIONS AT SATURATION FOR VARIOUS
 TEMPERATURES AT STANDARD PRESSURE (ATMOSPHERIC PRESSURE)

DEGREES C	DEGREES F	VOLUME %	DEGREES C	DEGREES F	VOLUME %
+100	+212	100.00	+ 2	+ 36	0.696
+ 90	+194	69.20	+ 1	+ 34	0.649
+ 80	+176	46.70	0	+ 32	0.602
+ 75	+167	38.70	-1	+ 30	0.555
+ 70	+158	30.70	-2	+ 28	0.510
+ 65	+149	25.20	-3	+ 27	0.469
+ 60	+140	19.70	-4	+ 25	0.431
+ 55	+131	15.50	-5	+ 23	0.396
+ 50	+122	12.20	-6	+ 21	0.363
+ 45	+113	9.45	-7	+ 19	0.333
+ 40	+104	7.25	-8	+ 18	0.305
+ 35	+ 95	5.55	-9	+ 16	0.281
+ 30	+ 86	4.19	-10	+ 14	0.256
+ 29	+ 84	3.95	-11	+ 12	0.234
+ 28	+ 82	3.73	-12	+ 10	0.214
+ 27	+ 81	3.62	-13	+ 9	0.196
+ 26	+ 79	3.32	-14	+ 7	0.179
+ 25	+ 77	3.13	-15	+ 5	0.163
+ 24	+ 75	2.94	-16	+ 3	0.148
+ 23	+ 73	2.77	-17	+ 1	0.135
+ 22	+ 72	2.61	-18	0	0.123
+ 21	+ 70	2.46	-19	-2	0.112
+ 20	+ 68	3.31	-20	-4	0.102
+ 19	+ 66	2.17	-22	-8	0.084
+ 18	+ 64	2.04	-24	-11	0.069
+ 17	+ 63	1.91	-26	-15	0.057
+ 16	+ 61	1.79	-28	-18	0.046
+ 15	+ 59	1.68	-30	-22	0.038
+ 14	+57	1.58	-32	-26	0.031
+ 13	+ 55	1.48	-34	-30	0.025
+ 12	+ 54	1.38	-36	-34	0.019
+ 11	+ 52	1.29	-38	-37	0.016
+ 10	+ 50	1.21	-40	-40	0.013
+ 9	+ 48	1.13	-42	-44	0.011
+ 8	+ 46	1.03	-44	-47	0.008
+ 7	+ 45	0.988	-46	-51	0.006
+ 6	+ 43	0.922	-48	-54	0.005
+ 5	+ 41	0.861	-50	-58	0.004
+ 4	+ 39	0.803	-52	-62	0.003
+ 3	+ 37	0.751	-54	-65	0.002



MOISTURE CONVERSION TABLE					
DEW POINT °F	DEW POINT °C	VAPOR PRESSURE Mm Hg	ppm by VOLUME	RELATIVE HUMIDITY @70°F	ppm by WEIGHT in air
-110	-166	.0000010	.00132	.0000053	0.00082
-108	-162	.0000018	.00237	.0000096	.0015
-106	-159	.0000028	.00368	.000015	.0023
-104	-155	.0000043	.00566	.000023	.0035
-102	-152	.0000065	.00855	.000035	.0053
-100	-148	.0000099	.0130	.000053	.0081
-98	-144	.000015	.0197	.000080	.012
-96	-141	.000022	.0289	.00012	.018
-94	-137	.000033	.0434	.00018	.027
-92	-134	.000048	.0623	.00026	.039
-90	-130	.00007	.0921	.00037	.057
-88	-126	.00010	.132	.00054	.082
-86	-123	.00014	.184	.00075	.11
-84	-119	.00020	.263	.00107	.16
-82	-116	.00029	.382	.00155	.24
-80	-112	.00040	.562	.00214	.33
-78	-108	.00056	.737	.00300	.46
-76	-105	.00077	1.01	.00410	.83
-74	-101	.00105	1.38	.00559	.86
-72	-98	.00143	1.88	.00762	1.17
-70	-94	.00194	2.55	.0104	1.58
-68	-90	.00261	3.43	.0140	2.13
-66	-87	.00349	4.59	.0187	2.84
-64	-83	.00464	6.11	.0248	3.79
-62	-80	.00614	8.08	.0328	5.01
-60	-76	.00808	10.6	.043	6.59
-58	-72	.0106	13.9	.0565	8.63
-56	-69	.0138	18.2	.0735	11.3
-54	-65	.0178	23.4	.0948	14.5
-52	-62	.0230	30.3	.123	18.8
-50	-58	.0295	38.8	.157	24.1
-48	-54	.0378	49.7	.202	30.9
-46	-51	.0481	63.3	.257	39.3
-44	-47	.0609	80.0	.325	49.7
-42	-44	.0768	101	.410	62.7
-40	-40	.0966	127	.516	78.9
-38	-36	.1209	159	.644	98.6
-36	-33	.1507	198	.804	122.9
-34	-29	.1873	246	1.00	152
-32	-26	.2318	305	1.24	189
-30	-22	.2859	376	1.52	234
-28	-18	.351	462	1.88	287
-26	-15	.430	566	2.30	351
-24	-11	.526	692	2.81	430
-22	-8	.640	842	3.41	523
-20	-4	.776	1020	4.13	633
-18	0	.939	1240	5.00	770
-16	+3	1.132	1490	6.03	925
-14	+7	1.361	1790	7.25	1110
-12	+10	1.632	2150	8.69	1335
-10	+14	1.950	2570	10.4	1596
-8	+18	2.326	3060	12.4	1900
-6	+21	2.765	3640	14.7	2260
-4	+25	3.280	4230	17.5	2680
-2	+28	3.880	5100	20.7	3170
0	+32	4.579	6020	24.4	3640
+2	+36	5.294	6970	28.2	4330
+4	+39	6.101	8030	32.5	4990
+6	+43	7.013	9230	37.4	4730
+8	+46	8.045	10590	42.9	6580
+10	+50	9.029	12120	49.1	7530
+12	+54	10.52	13840	56.1	8600
+14	+57	11.99	15780	63.9	9800
+16	+61	13.63	17930	72.6	11140
+18	+64	15.48	20370	82.5	12650
+20	+68	17.54	23080	93.5	14330
+22	+71	19.827	26088		16699
+24	+75	33.377	29443		18847
+26	+79	25.209	33169		21232

Appendix F: Warranty and Disclaimer

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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