

**Baldwin™-Series**  
**Model 8210**  
**Thermo-Electric Cooler**  
User's Manual



PERMA PURE LLC

A HALMA COMPANY

8 Executive Drive • P.O. Box 2105 • Toms River, NJ 08754

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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 8210 thermo-electric cooler
- (1) User's Manual

Optional glass impingers will ship separately.

If any of the above parts are missing or damaged, call the helpline at **(800) 337-3762 ext-145.**

## 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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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.

## General description

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 compounds of interest. The Baldwin-Series Classic TE Cooler is an ideal way to decrease the dew point of combustion gases to a repeatable, stable, constant low dew point. The Classic cooler prevents water condensation in sample pre-filters, pumps, and analyzers. For gas analyzers where water vapor is an interferent, a stable, repeatable dew point becomes a part of the gas analyzer performance specification. Classic coolers provide this constant low water concentration, resulting in an accurate gas measurement.

All Classic coolers use thermo-electric elements (Peltiers) to cool the sample gas to the desired dew point temperature. A Classic Thermo-Electric (TE) Cooler is best illustrated as a small heat pump with no moving parts. The Peltier operates on direct current and may be used for heating or cooling by reversing the direction of current flow. This is achieved by moving heat from one side of the module to the other with current flow and the laws of thermodynamics. A typical single stage Peltier (Figure 1) consists of two ceramic plates with p- and n-type semiconductor material (bismuth telluride) between the plates. The elements of semiconductor material are connected electrically in series and thermally in parallel.

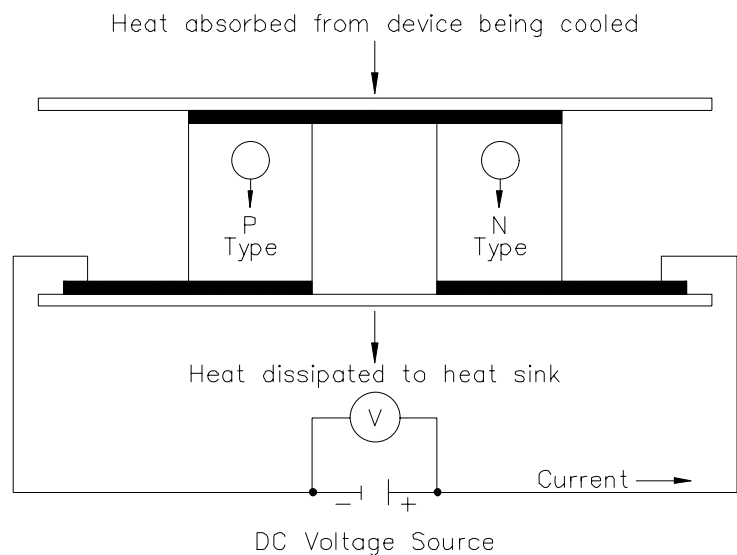


Figure 1: Thermo-electric element (Peltier)

When a positive DC voltage is applied to the n-type thermo-electric element, electrons pass from the p- to the n-type thermo-electric element and the cold side temperature will decrease as heat is absorbed. The heat absorption (cooling) is proportional to the current and the number of thermo-electric couples. This heat is transferred to the hot side of the Peltier element where it is dissipated into the heat sink and surrounding environment.

The Classic Cooler removes the moisture from the sample gas by cooling it as it passes through a laminar impinger (heat exchanger). A diagram showing the gas flow path through an impinger is shown in the Appendix. The heat exchanger, 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 heat exchanger without a mechanical lock. This assembly allows the easy removal of any heat exchanger 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 heat from the heat transfer block is pumped to the heat sink where it is then dissipated into the air by the heat sink fan. See Figure 2. 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 in the heat transfer block located very close to the cold side of the peltier element as the input sensor.

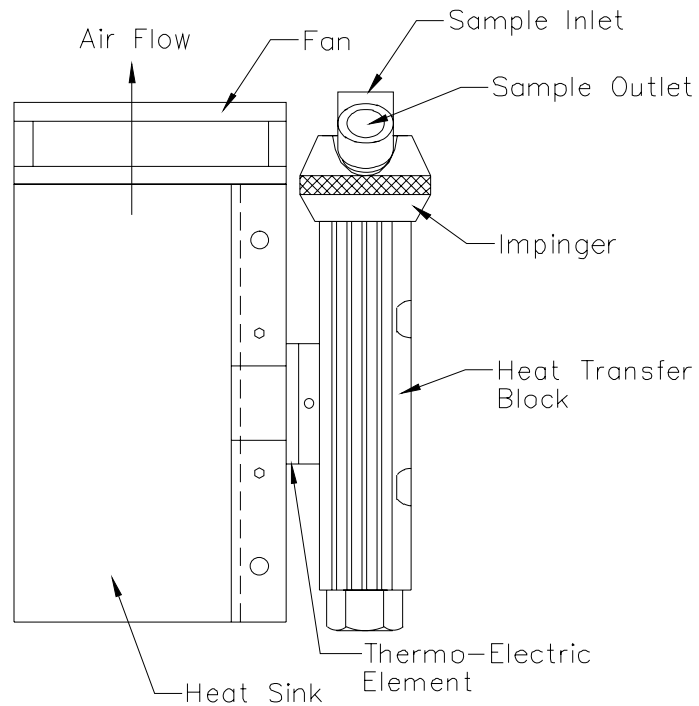


Figure 2: Heat Exchanger, Impinger and Heat Sink

The sample gas is passed to the cooler via the heated filter sample probe and heated sample line. The cooler lowers the sample dew point to 5°C (41°F). As the gas cools and the moisture vapor condenses, the condensate exits the heat exchanger through the bottom drain connection. Particulate matter passing through the sample cooler can be removed by an optional Baldwin-Series pre-filter, located downstream from the cooler along with an optional water slip sensor. The conditioned sample gas can then be directed to the gas analyzers.

## **Physical Description**

- Single (Series) or Dual (Parallel) stream system
- 2 x 10" heat exchangers connected in series or parallel
- 2 Active (cooled to 4°C) heat exchangers
- LCD temperature display
- Dimensions: 14.5" x 11" x 10.5" HWD (37 x 28 x 26.5 cm)
- Weight: 35 lbs (16 kg)

## **Specifications**

Sample gas flow range	Up to 11 LPM (Up to 23.3 SCFH)
Avg. inlet dew point at rated flow	20% H <sub>2</sub> 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; 760 mmHg)
Maximum pressure drop	< +1 in H <sub>2</sub> O
Ambient temperature range	33-110°F (0.6-43°C)
Outlet sample gas dew point	41°F (5°C)
Voltage	115/230 VAC 50/60 Hz
Power supply	500W
Cooling down time	Less than 6 minutes

## **Connections**

- Sample gas inlet: Kynar, 3/8" tube compression fitting
- Sample gas outlet: Kynar, 1/4" tube compression fitting
- Drain tubing connection: Kynar, 3/8" tube compression x 1/4" barbed tube fitting

***An automatic condensate drain, dual-head peristaltic drain pump is recommended for water removal, Perma Pure part number 3KPB-003; size 17 tubing.***

Always use factory supplied fittings; Perma Pure cannot warrantee against damage to the Peltier elements or heat exchangers if our fittings are not used.



## **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 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

## Installation

### Hardware required for installation

- (4) ¼-20 mounting screws
- For stainless steel sample lines, 2 inches of 3/8" Teflon tube
- Peristaltic drain pump, dual head

### Mounting

The Classic Model 8210 Thermo-Electric Cooler should be installed away from heat sources in a well vented area.

**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. Also, at or near this temperature, the cooler will be running "full on" and Peltier life will be greatly reduced.

## Connections

### Sample and Drain

1. Connect the sample inlet to the 3/8" tube fitting shown in figure 1.

**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.**

2. Connect the sample outlet to the 1/4" tube fitting shown in figure 1.
3. Connect the peristaltic pumps to the 1/4" barbed tube fittings shown in figure 1.

**NOTE: Do not reduce the size of the condensate tubing since doing so restricts water flow resulting in water carryover into the sample.**

For instructions on installing a Perma Pure peristaltic pump, see appendix 1. Note that the rating on this pump tubing is 20 psi (1.7 bar).

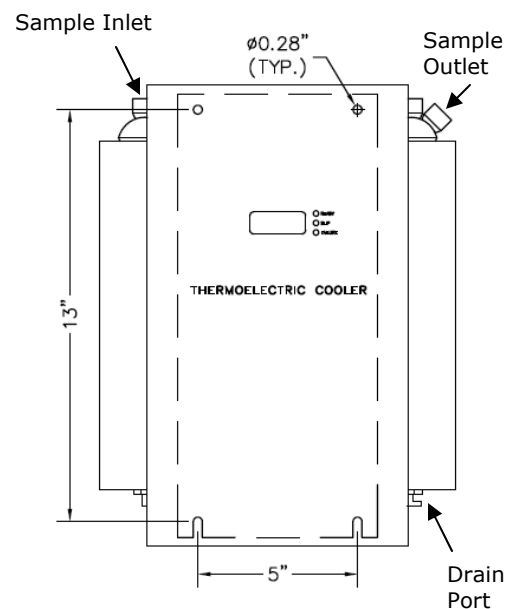


Figure 1 - Model 8210 Cooler





### **Electrical –Relay Board**

Make the following connections while referring to Appendix B3: Interconnect wiring diagram.

- Computer status alarms wire to TB2
  - a. Terminals 1 and 3 for water slip alarms
  - b. Terminals 4 and 6 for ready/slip alarm status
  
- Sample pump control-water slip only
  - a. Jumper line, neutral, and ground from the power supply line terminals to TB8 (GNL) on the relay board.
  - b. Wire the sample pump power leads to TB2, terminals 6 (hot), 7 (neutral), and 8 (ground).
  
- Sample pump control-water slip plus read/slip/power fail safe start
  - a. Jumper hot, neutral, and ground from the power supply line terminals to TB8 (GNL) on the relay board.
  - b. Wire the sample pump power leads to TB2, 7 (neutral), and 8 (ground).
  - c. Wire a jumper on TB1 from terminal 3 to terminal 4, and wire another jumper on TB9 from terminal 1 to terminal 2.
  - d. Wire sample pump hot wire to TB9 terminal 5.
  - e. Wire water slip sensor to TB1 terminals 1 and 2.

Sample pump is now in series with water slip sensor and the ready/slip/power failure relay, which will only allow the sample pump to start if both conditions are true; ie. No water slip and safe operating temperature of the sampling system.

### **LED Summary**

The Classic Model 8210 has a dual-channel, digital operating temperature front panel indicator and 3 LED status displays for each channel, 2 green and 1 red. These indicators are arranged vertically on the front of the cooler.

- "Ready" Green LED comes on when output stream dew point is below 10°C.
- "Slip" Green LED comes on when water is not present on water slip sensor.
- "Failure" Red LED comes on if the thermocouple failed.

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.

**Classic Model 8210 is operating properly when both Green LED's are lit.**

### **Start-up**

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. 6 minutes. This will indicate the impinger temperature is below 10°C and the sample gas flow can begin.
3. After approx. 3 more minutes, the factory set-point of +5°C (41°F) will be reached.

The SLIP Green LED is always on unless;

- Moisture is detected by the water slip sensor
- There is a malfunction (eg. Shorted water slip sensor leads or a bad relay board)

NOTE: All voltages can be read at the PCB terminal strip.



## **Set Points**

Both the operating control temperature and ready relay set points are adjusted by 20 turn potentiometers located on the control board.

Using a digital voltmeter (DVM), attach the black lead to P1 for ground reference point and attach the red lead to test points 1, 2, or 3 located just above terminal TB1 where the control thermocouple terminates.

TP1 is the thermocouple zero/span adjustment test points, and should **not** be adjusted by the user.

TP2 is the control set point temperature (set point #2)

TP3 is the ready relay set point temperature (set point#3)

To adjust either set point, open the cooler front door, attach the DVM, and adjust the labeled potentiometer on the control card.

NOTE: These set point potentiometers are factory set and sealed for proper cooler operation. Please consult the factory before making any changes to these set point adjustments.

**SET POINT #2 is factory adjusted to 5°C (.500 VDC)**  
**SET POINT #3 is factory adjusted to 10°C (1.00 VDC)**

## 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 no fan.	DC 3A fuse (F1) on control Bd. AC 15A fuse on power supply. Check for +15VDC at P1 & P11 of control bd.	Replace fuse as necessary. Replace fuse as necessary. If low reading, remove wires from P1 & P11, measure at power supply and replace supply if voltage still is low.
LED(s) on and no fan.	Wire harness at P10 on control board over to P1 on relay boards. Relay Board for +12VDC at TB7 pins 1&2 and 3&4.	If loose then reseal connectors. If no voltage or low reading, replace relay board.
F1 on control board keeps blowing.	Replace fuse (3A) and disconnect P10 cable going to relay board.	If fuse does not blow, replace relay board.
Impinger remains at ambient temperature.	Peltier current draw. Should be between 6 and 8 amps.	Replace Peltier element.
Thermocouple failure LED is on.	Thermocouple connection TB1.	Ensure proper connection. Try a good thermocouple in place of old one Replace thermocouple.
Impinger frozen and cooler indicates ambient temperature.	Thermocouple placement in heat exchanger block. Peltier current draw (>6A) for both elements on that channel.	Ensure proper placement.  Replace bad peltier
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. Adjust as necessary.
Impinger temperature cycles up and down.	Peltier connections on control board.  Ferrite bead on thermocouple going into terminal TB1.	Ensure a firm connection on flag connectors on control board. Ensure system loading is not exceeding cooler capacity. Wrap thermocouple wires around a Ferrite bead



Water carryover in system.	Impinger temperature. Should be below 6°C.	Ensure system loading is not exceeding cooler capacity.
Slip LED does not come on	Water carryover in system.  Water slip sensor connections.	Ensure system loading is not exceeding cooler capacity.  Ensure that all water slip sensor connections are made. Disconnect sensor at base of unit, Clean tip of sensor. Replace alarm relay/water slip board.
Pump does not start. Ready and slip LED(s) are on	Pump electrical connections.	Ensure proper connections. Replace board.

## **Replacement Parts**

### **Classic Model 8210**

<b>Part No.</b>	<b>Description</b>
3CCB-011*	Control Board: Dual Channel
2FAN-005	Fan: Muffin, 4" x 1", 12 VDC
2FAN-007	Fan: Muffin, 6" x 1½", 120 VAC
2FAN-008	Fan: Muffin, 6" x 1½", 230 VAC
3CXD-022	Impinger: 10" EZ-clean twist-apart Durinert®
3CXD-024	Impinger: 10" NJ, EZ-clean twist-apart Durinert coated
3CXG-002	Impinger: 10" Glass, threaded w/ fittings
3CXK-003	Impinger: 10" Kynar
3CXS-022	Impinger: 10" Stainless Steel, EZ-clean twist-apart
3CXS-024	Impinger: 10" NJ, Stainless Steel, EZ-clean twist-apart
3KPE-004*	Peltier Element Kit, 40 mm
1PSD-009*	Power Supply: 500 W, 15 VDC
3CCB-005*	Relay Board: Dual Channel
1TTC-001	Thermocouple: Temperature, Control, Type K, 24"

\* Recommended Spares

### **Sample Conditioning Systems w/ Classic Model 8210 Thermo-Electric Cooler**

<b>Part No.</b>	<b>Description</b>
3KFA-001	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
2PBM-003	Peristaltic Pump: Head Only, Standard
2PBM-001	Peristaltic Pump: Motor Only, 115V AC 60 Hz
2PBT-002PK*	Peristaltic Pump: Tubing, Norprene, Size 17 (10 feet)
3KPA-002*	Sample Pump: Assembly, Dual Head w/ Check Valve, 115V
2PAM-002*	Sample Pump: Repair Kit, Dual
3KCW-007	Water Slip Sensor (SS Pins) w/ Holder Assembly

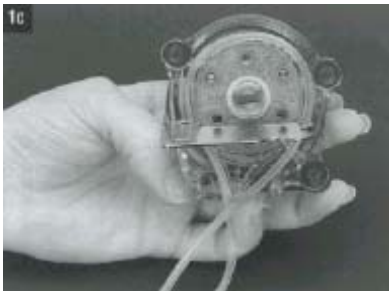
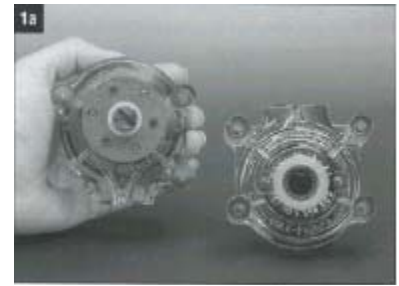
\* Recommended Spares    \*\*Consumables

## **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**

- a) Separate the end bells (the pump head halves). Hold the end bell containing the rotor as shown with the tubing retainer grooves facing down.
- b) 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.
- c) 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.
- d) 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).
- 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**

- a) Load the pump heads with tubing.
- b) Install the four correct length mounting screws in drive.
- c) Slide the first pump head into the mounting screws.
- d) 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).
- e) Repeat for each additional pump head, aligning pump head tang with slot on previously mounted pump head.
- f) Slide the flow flat washers onto screws and secure with the four wingnuts. Tighten with fingers only.



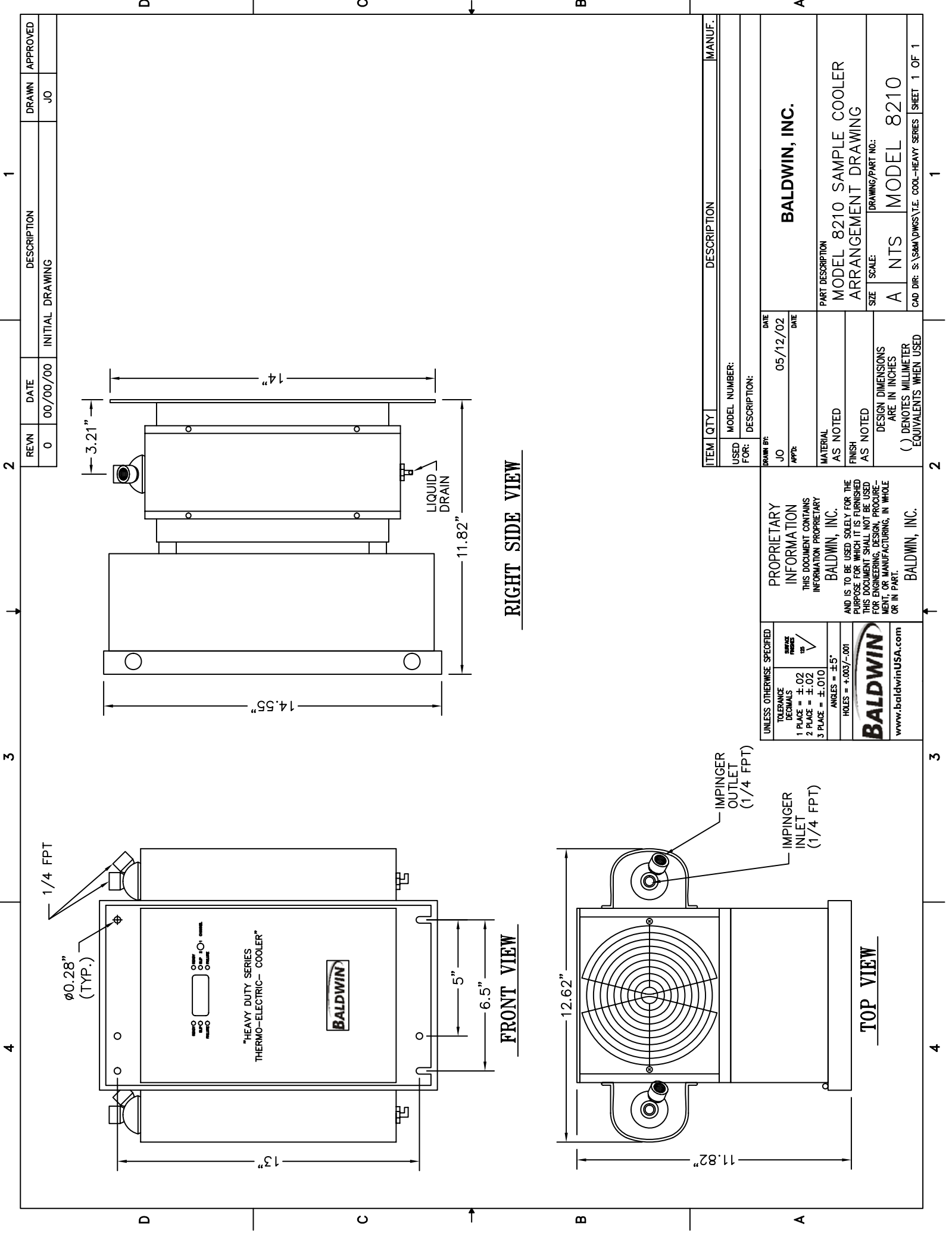
### **Replacement parts**

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-015	Single head hardware kit
2PBM-006	Dual head hardware kit

## **Appendix B: Cooler Drawings**

- B1: Model 8210 dimensional drawing
- B2: Impinger diagram
- B3: Power supply diagram
- B4: Interconnect wiring diagram
- B5: Relay diagram
- B6: Contact states diagram





REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	JO	

ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:	MODEL NUMBER:		
DESCRIPTION:			

DRAWN BY:	DATE	
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APP'D:		

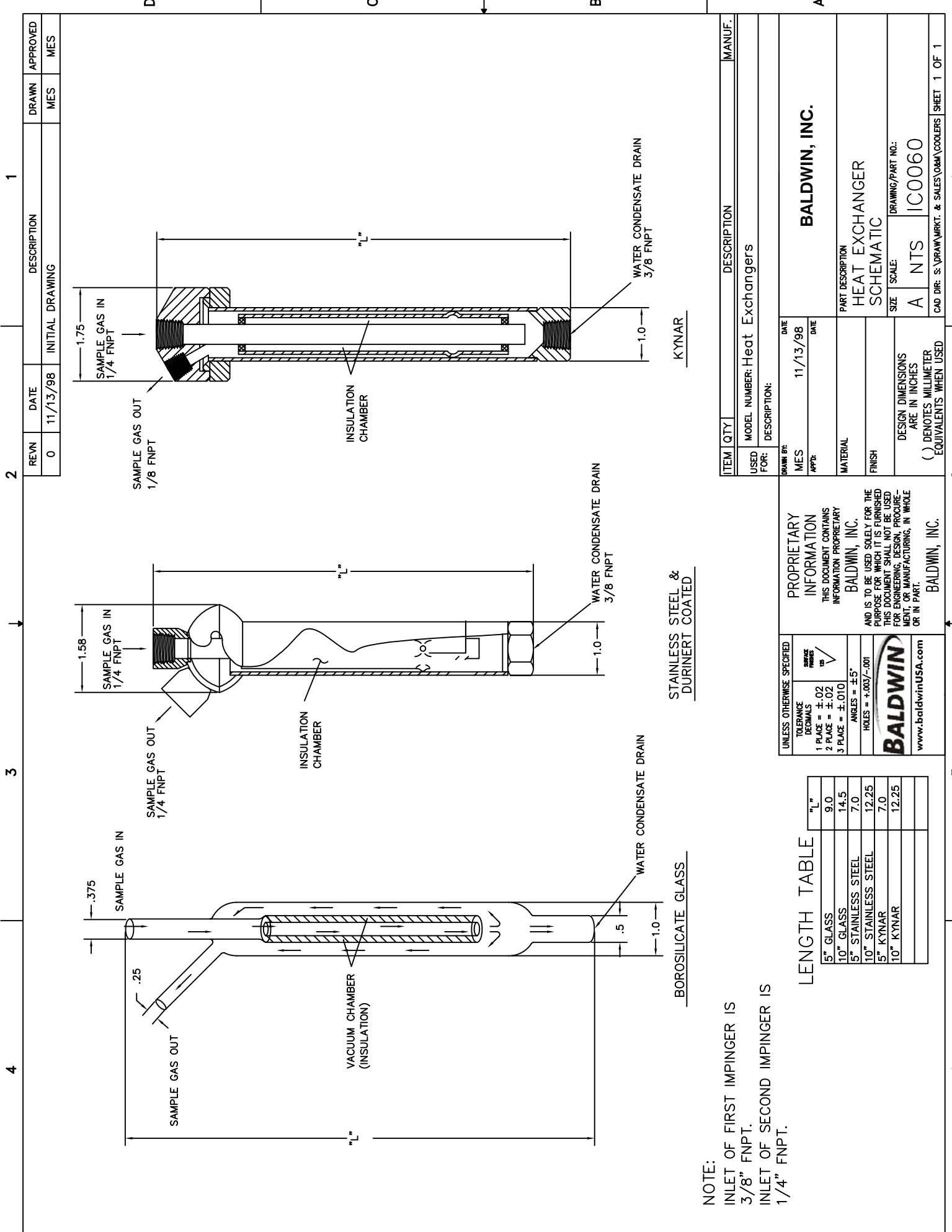
MATERIAL	AS NOTED
FINISH	AS NOTED
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() DENOTES MILLIMETER EQUIVALENTS WHEN USED	

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TOLERANCE DECIMALS	ANGULAR FINISHES
1 PLACE = ±.02	✓
2 PLACE = ±.02	
3 PLACE = ±.010	
ANGLES = ±5°	
HOLES = +.003/-001	

www.baldwinUSA.com	

PART DESCRIPTION MODEL 8210 SAMPLE COOLER ARRANGEMENT DRAWING	
SIZE	A NTS
DRAWING/PART NO.:	MODEL 8210
CAD DIR: S:\S6M\DWGS\T.E. COOL-HEAVY SERIES SHEET 1 OF 1	



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

UNLESS OTHERWISE SPECIFIED	
TOLERANCE DECIMALS	FRACTIONS
1 PLACE = ±.02	1/16
2 PLACE = ±.02	1/32
3 PLACE = ±.010	1/64
ANGLES = ±5°	
HOLES = +.003/- .001	
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DESIGN DIMENSIONS ARE IN INCHES ( ) DENOTES MILLIMETER EQUIVALENTS WHEN USED	DATE 11/13/98
MATERIAL	DATE
FINISH	
SIZE SCALE: A NTS	DRAWING/PART NO.: IC0060

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DRAWING/PART NO.: IC0060	
CAD DIR: s:\DRAW\WRKT. & SALES\O&M\COOLERS	

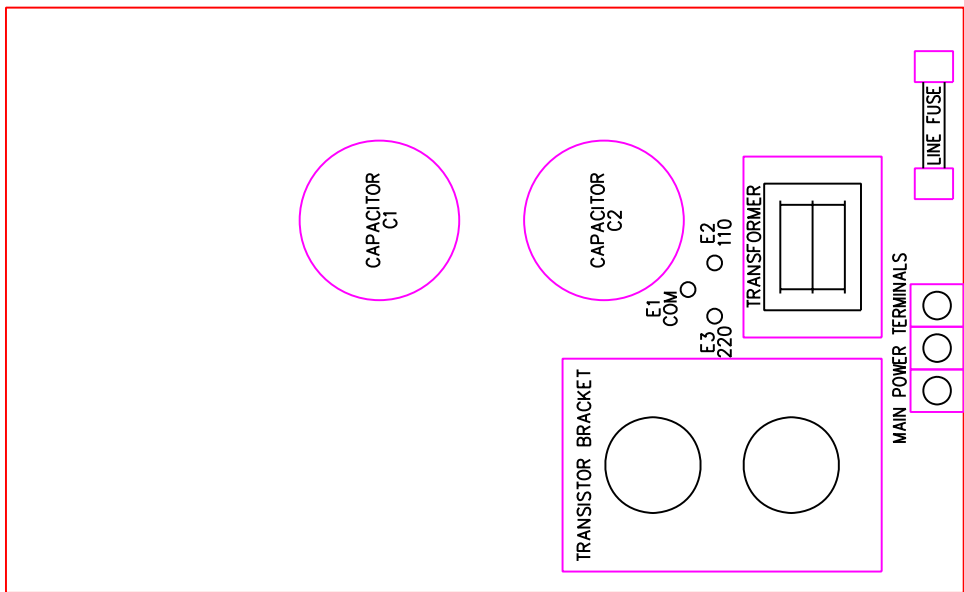
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USED FOR:		MODEL NUMBER: Heat Exchangers	
DESCRIPTION:			

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1  
2  
3  
4

1  
2  
3  
4

REVN	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	LD	RD



POWER SUPPLY MAINS JUMPER PROCEDURE:

1. FOR 110VAC 60Hz JUMPER COMMON (E1) TO 110 (E2).
2. FOR 220VAC 50Hz JUMPER COMMON (E1) TO 220 (E3).

NOTE:  
CUT VALUE OF FUSE IN HALF WHEN SWITCHING FROM 110 VAC TO 220 VAC

ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:	MODEL NUMBER: All Baldwin Thermo-Electric Coolers		
DESCRIPTION:	POWER SUPPLY		
DRAWN BY:	DATE	DATE	
RAW APP'D:	04/28/97		
MATERIAL	PART DESCRIPTION		
FINISH	POWER SUPPLY MAINS JUMPER CONFIGURATION		
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( ) DENOTES MILLIMETER EQUIVALENTS WHEN USED	A	NTS	5C-PJUMP
CAD DIR: S:\DRAWING\SCHEMATICS\ELECTRICAL		SHEET 1 OF 1	

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UNLESS OTHERWISE SPECIFIED	SWAGE PIPES
TOLERANCE DECIMALS	VS
1 PLACE = ± .02	
2 PLACE = ± .002	
3 PLACE = ± .010	
ANGLES = ± 5°	
HOLES = +.003/-001	



REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	LD	RD

METER CALIBRATION  
REF TP1 - .04VDC = 4°C

S1 (2 CHANNEL UNIT ONLY)  
(FRONT SIDE OF BOARD)  
RIGHT - CHANNEL 1  
LEFT - CHANNEL 2

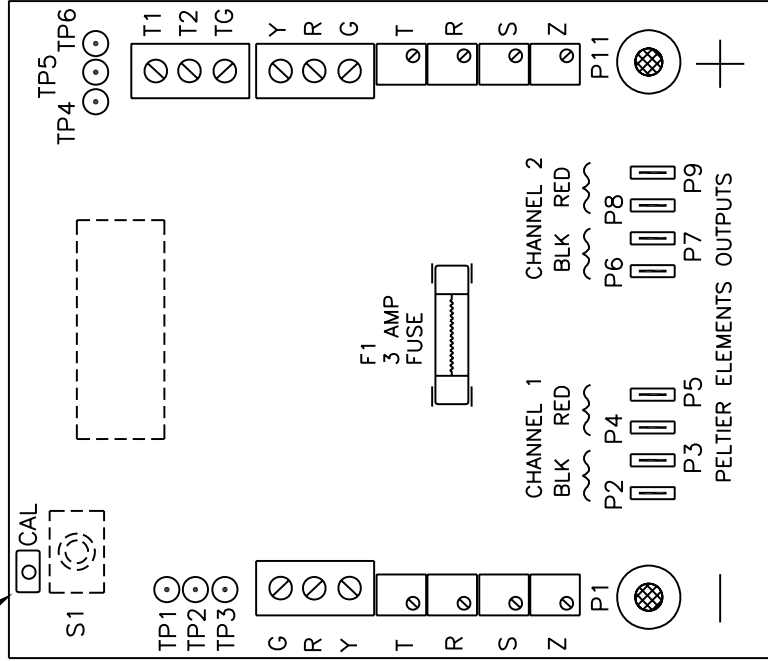
CHANNEL 1 ADJUSTMENT TEST PTS  
REF. TO VDC GRD 0.01VDC/°C  
TP1 ZERO/SPAN ADJUSTMENT  
TP2 SET OPERATING TEMPERATURE  
TP3 SET READY TEMPERATURE

CHANNEL 1  
K TYPE THERMOCOUPLE INPUT  
CHANNEL 1 - IMPINGER TEMP

CH 1 SET POINT (5°C/0.05VDC @ TP2)  
CH 1 READY SET POINT (10°C/0.10VDC @ TP3)

CH 1 SAMPLE CHILLER ZERO/SPAN  
RANGE OF CALIBRATION 0°C-25°C  
ADJUST @ TP1

GROUND FROM POWER SUPPLY



CHANNEL 2 ADJUSTMENT TEST PTS  
REF. TO VDC GRD 0.01VDC/°C  
TP4 ZERO/SPAN ADJUSTMENT  
TP5 SET OPERATING TEMPERATURE  
TP6 SET READY TEMPERATURE

TEMPERATURE OUTPUT  
TG - GROUND  
T2 - (OPTIONAL NJ) CHANNEL 2 CONTROL TEMP. 0.1VDC  
T1 - (STANDARD) CHANNEL 1 CONTROL TEMP. 0.01VDC/°C

CHANNEL 2 OR SAMPLE TEMP OPTION  
K TYPE THERMOCOUPLE INPUT  
2 CHANNEL SYSTEM - IMPINGER TEMP OR  
OPTIONAL NJ SYSTEM - EXITING SAMPLE TEMP.

CH 2 SET POINT (5°C/0.05VDC @ TP5)  
CH 2 READY SET POINT (10°C/0.10VDC @ TP6)

SPAN } CH 2 SAMPLE CHILLER ZERO/SPAN  
RANGE OF CALIBRATION 0°C-25°C  
ZERO } ADJUST @ TP4

+15VDC (14.72VDC) FROM POWER SUPPLY

ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:		MODEL NUMBER: 8210 & 20410	
DESCRIPTION:			

DATE	04/10/97
APP'D:	
MATERIAL	
FINISH	
DESIGN DIMENSIONS ARE IN INCHES ( ) DENOTES MILLIMETER EQUIVALENTS WHEN USED	
SIZE	A NTS
DRAWING/PART NO.:	3CCB-011
CAD DIR:	S:\DRAWING\SCHEMATICS\ELECTRICAL
SHEET	1 OF 1

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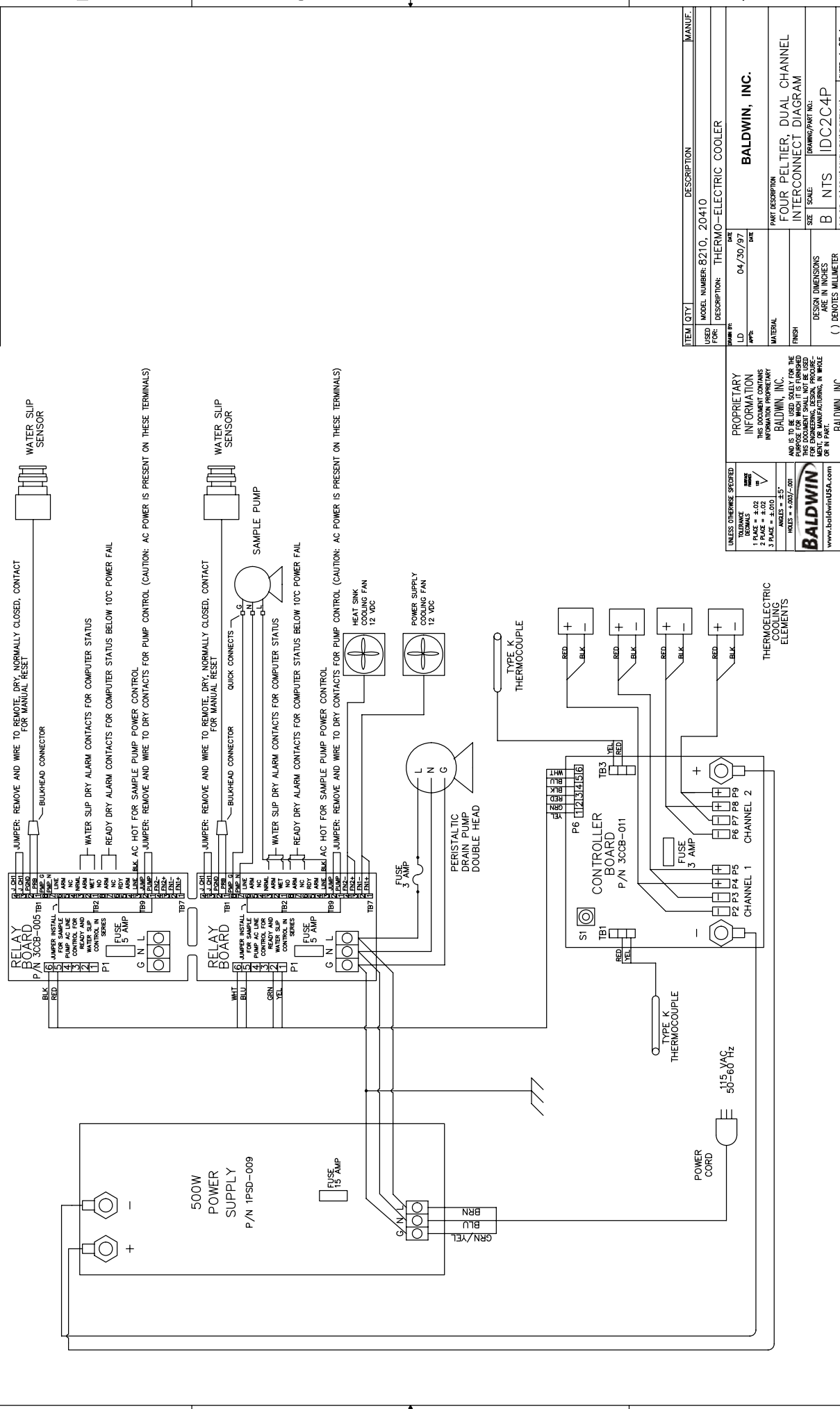
BALDWIN, INC.  
www.baldwinUSA.com

UNLESS OTHERWISE SPECIFIED	ANGLE = ±5°
TOLERANCE DECIMALS	HOLES = ±.003/-001
1 PLACE = ±.02	
2 PLACE = ±.02	
3 PLACE = ±.010	

BALDWIN, INC.

TEMPERATURE CONTROL BOARD  
ARRANGEMENT DRAWING

REVW	DATE	DESCRIPTION	1
0	00/00/00	INITIAL DRAWING	
		DRAWN	APPROVED



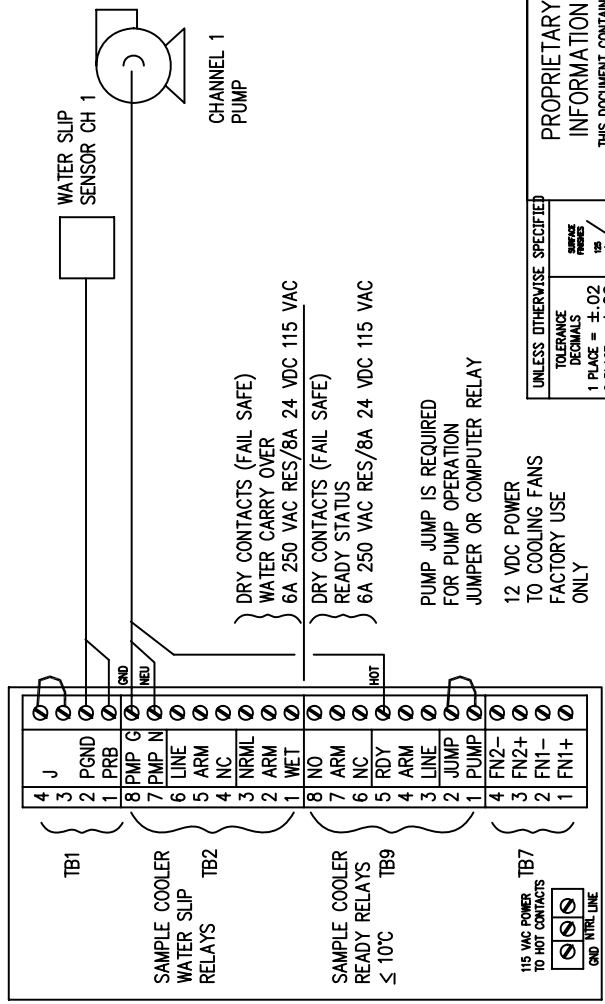
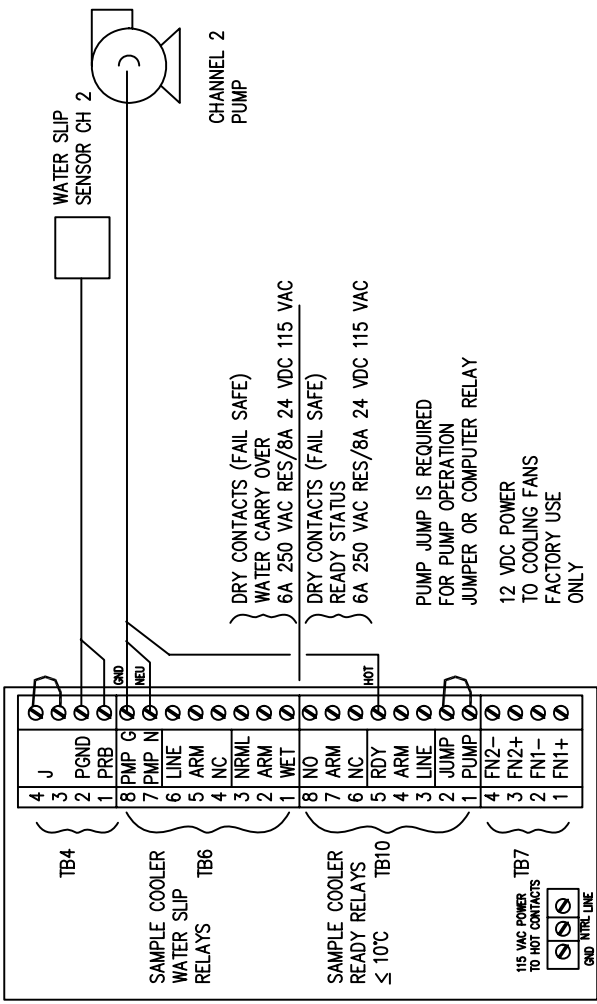
ITEM QTY	DESCRIPTION
USED MODEL NUMBER: 8210, 20410	
FOR: DESCRIPTION: THERMO-ELECTRIC COOLER	
MANUFACTURE DATE	
L.D. DATE	04/30/97
MATERIAL	
FINISH	
PART DESCRIPTION	BALDWIN, INC.
FOUR PELTIER, DUAL CHANNEL INTERCONNECT DIAGRAM	
SIZE SCALE	B NTS
DESIGN DIMENSIONS ARE IN INCHES	
( ) DENOTES MILLIMETER EQUIVALENTS WHEN USED	
DOC. NO. S:\DRAWINGS\ELECTRICAL	SHEET 1 OF 1

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UNLESS OTHERWISE SPECIFIED:  
1. TOLERANCES  
2. FINISHES  
3. PLACES = ±.010

ANGLES = ±5°



ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:		MODEL NUMBER: 8210, 20410	
DESCRIPTION:			
DRAWN BY:		DATE	
RAW		01/13/04	
APP'D			
MATERIAL			
FINISH			
DESIGN DIMENSIONS ARE IN INCHES		SIZE	
() DENOTES MILLIMETER EQUIVALENTS WHEN USED		A	NTS
		DRAWING/PART NO.	3CCB-005
		CAD DIR:	S:\DRAWING\SCHEMATICS\ELECTRICAL
			SHEET 1 OF 1

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UNLESS OTHERWISE SPECIFIED	TOLERANCE DECIMALS	ANGLE FINISHES
1 PLACE = ±.02	2 PLACE = ±.02	3 PLACE = ±.010
ANGLES = ±5°		
HOLES = +.003/-001		
 www.baldwinUSA.com		

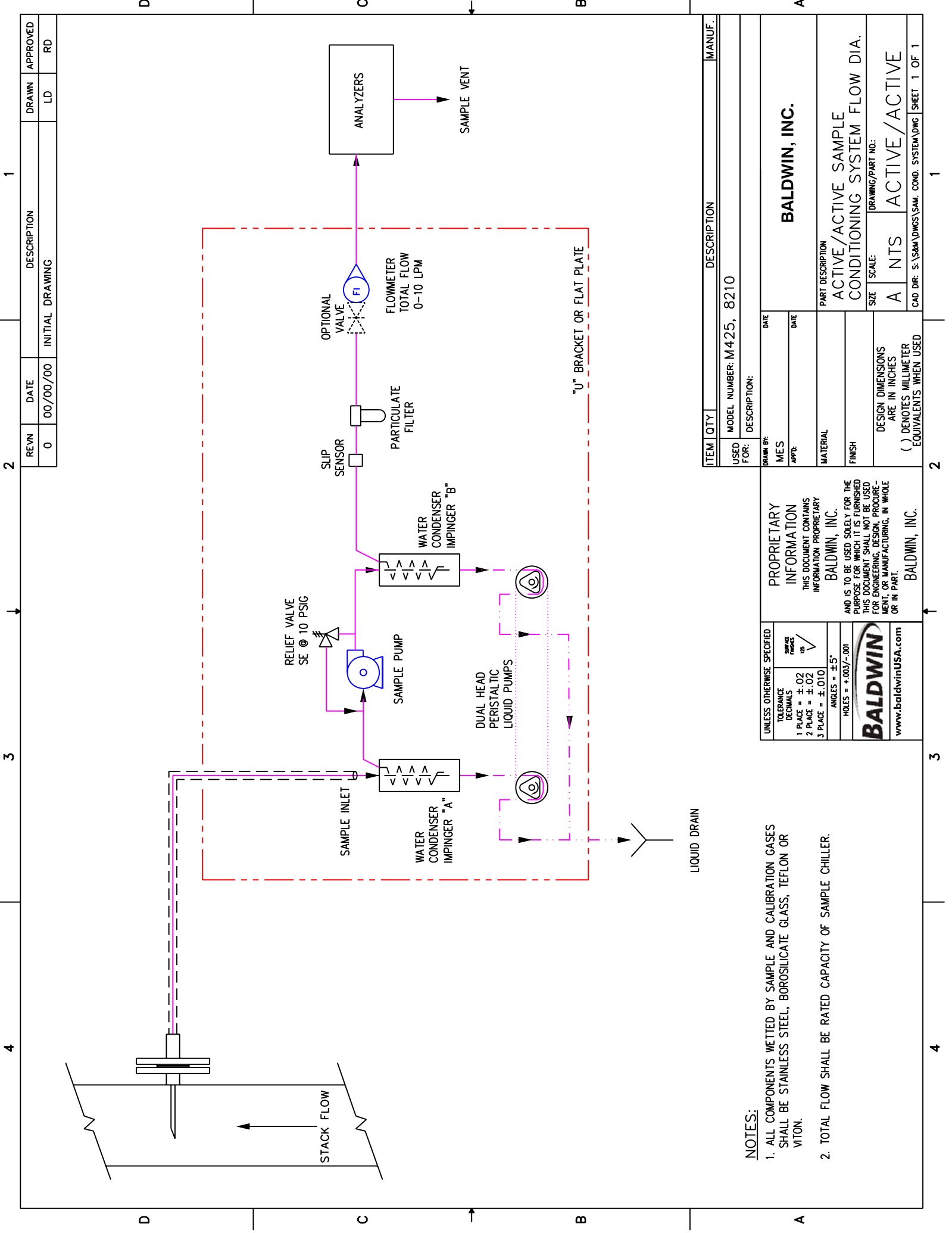




## **Appendix C: Sample Conditioning System Drawings**

- C1: Flow schematic
- C2: 4S-9AA Single stream piping and dimensional drawing
- C3: 4S-9AA Dual stream piping and dimensional drawing
- C4: Rack mounting plates dimensional drawing
- C5: Wall mounting plates dimensional drawing





REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	LD	RD

ITEM	QTY	DESCRIPTION	MANUF.
USED FOR: MODEL NUMBER: M425, 8210			
DESCRIPTION:			
DRAWN BY: MES		DATE:	
APP'D:		DATE:	
MATERIAL:		PART DESCRIPTION:	
FINISH:		ACTIVE/ACTIVE SAMPLE	
DESIGN DIMENSIONS ARE IN INCHES		CONDITIONING SYSTEM FLOW DIA.	
() DENOTES MILLIMETER EQUIVALENTS WHEN USED		DRAWING/PART NO.:	
		SIZE:	A NTS
		ACTIVE/ACTIVE	
CAD DIR: S:\56M\DWG\SAM_COND_SYSTEM\DWG SHEET 1 OF 1			

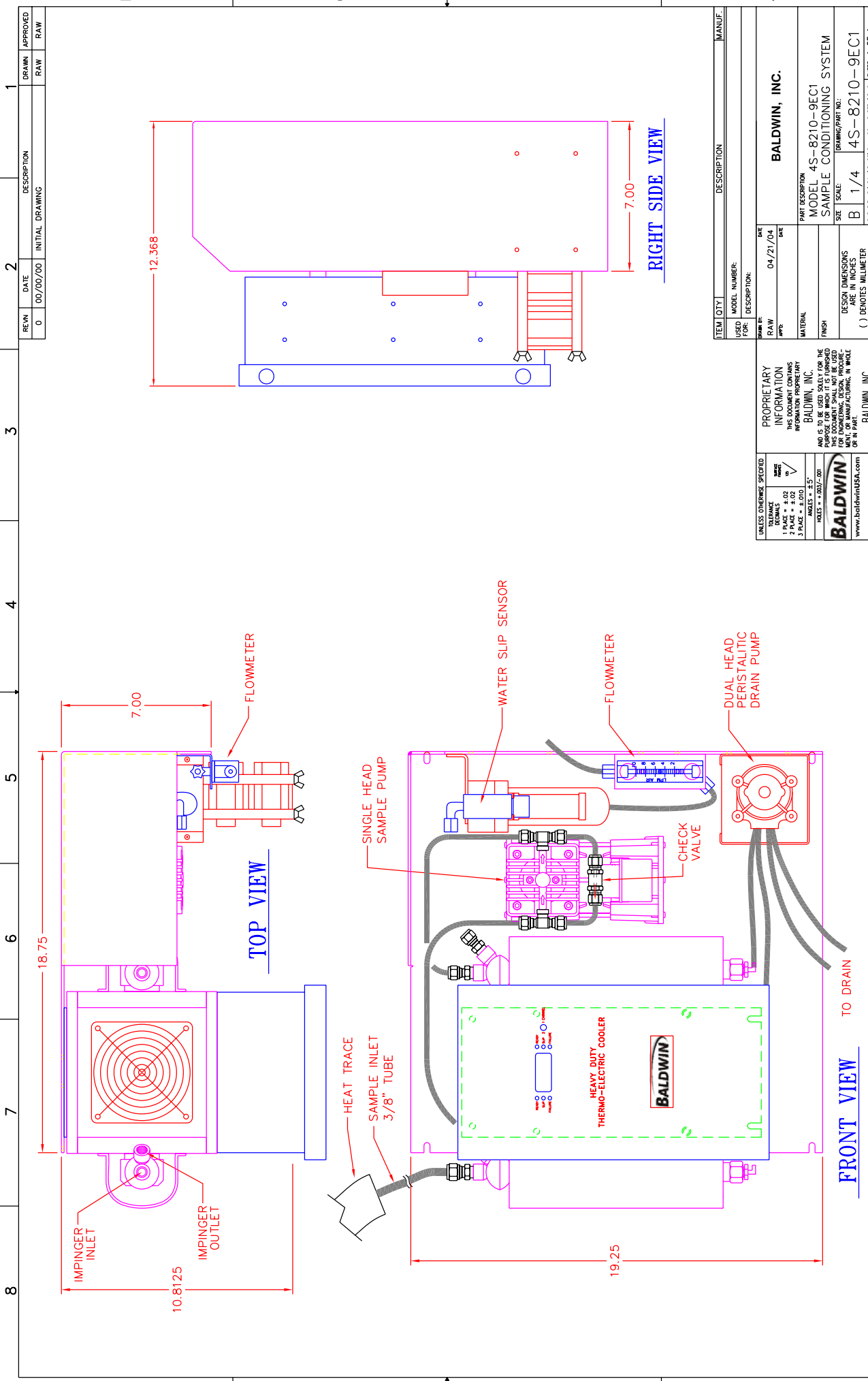
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UNLESS OTHERWISE SPECIFIED	
TOLERANCE DECIMALS	ANGLES IN DEGREES
1 PLACE = ± .02	VS
2 PLACE = ± .002	
3 PLACE = ± .010	
ANGLES = ± 5°	
HOLES = +.003/-000	

- NOTES:**
- ALL COMPONENTS WETTED BY SAMPLE AND CALIBRATION GASES SHALL BE STAINLESS STEEL; BOROSILICATE GLASS, TEFLON OR VITON.
  - TOTAL FLOW SHALL BE RATED CAPACITY OF SAMPLE CHILLER.



REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	RAW	RAW

ITEM	QTY	DESCRIPTION	MANUF.
USED	MODEL NUMBER:		
FOR:	DESCRIPTION:		
RAW	DATE:	04/21/04	
RAW	DATE:		
MATERIAL:	PART DESCRIPTION:	BALDWIN, INC.	
FINISH:	MODEL:	MODEL 4S-8210-9EC1	
	SAMPLE:	SAMPLE CONDITIONING SYSTEM	
	SIZE:	1/4	
	SCALE:	AS-8210-9EC1	
	QTY:	1	

UNLESS OTHERWISE SPECIFIED:  
 TOLERANCES:  
 1 PLACE = ±0.02  
 2 PLACE = ±0.01  
 3 PLACE = ±0.005  
 Holes = ±0.01

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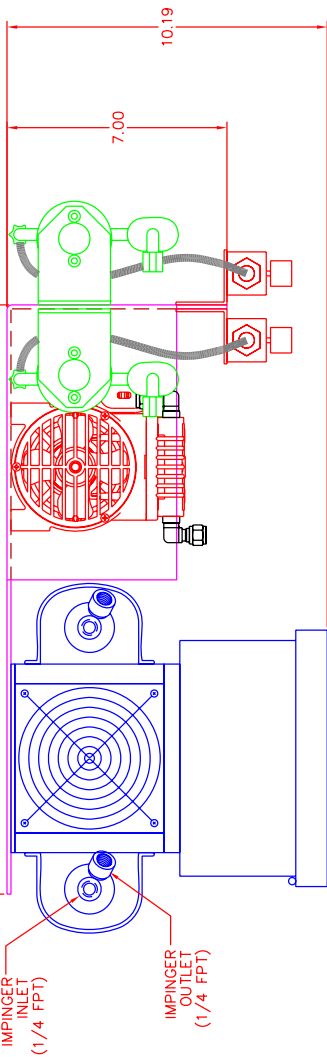
1  
2  
3  
4  
5  
6  
7  
8

A  
B  
C  
D

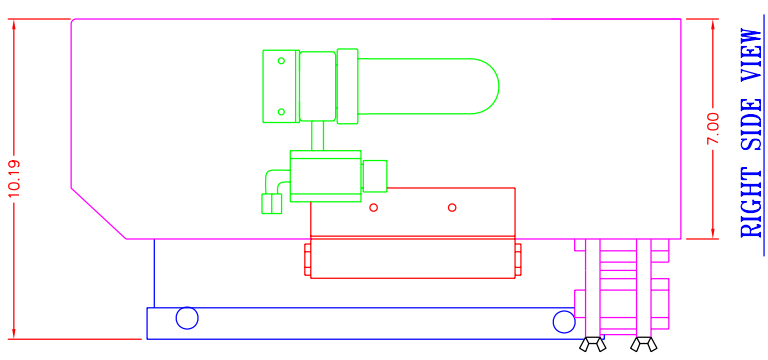


REVW	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	RAW	RAW

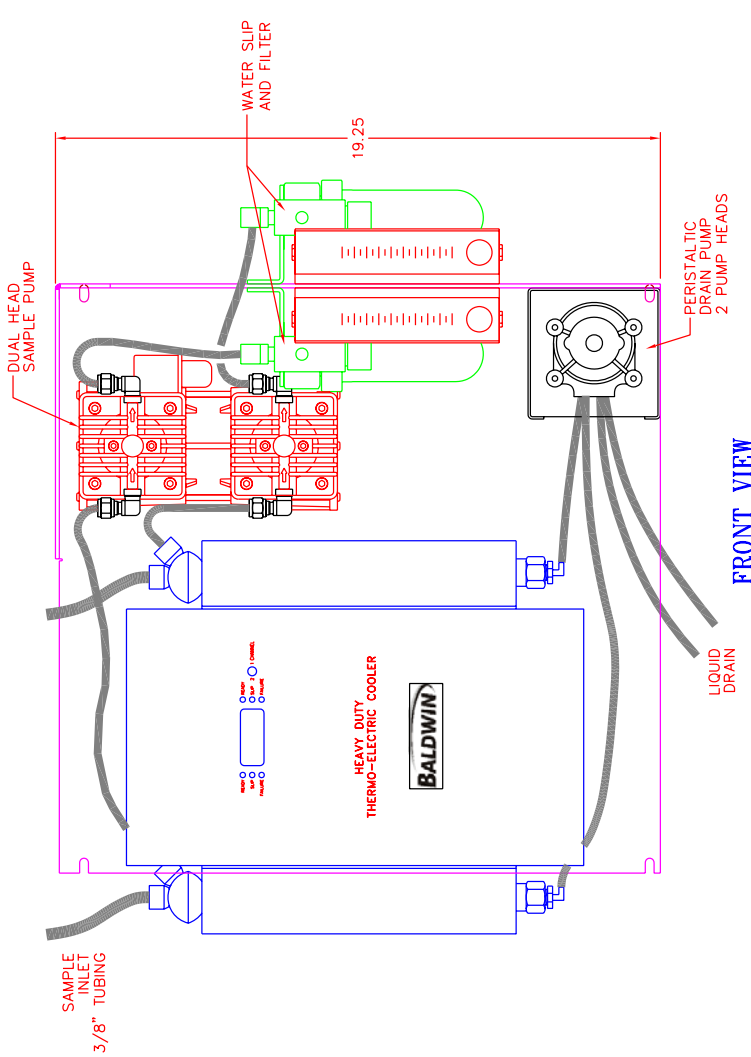
1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---



**TOP VIEW**



**RIGHT SIDE VIEW**



**FRONT VIEW**

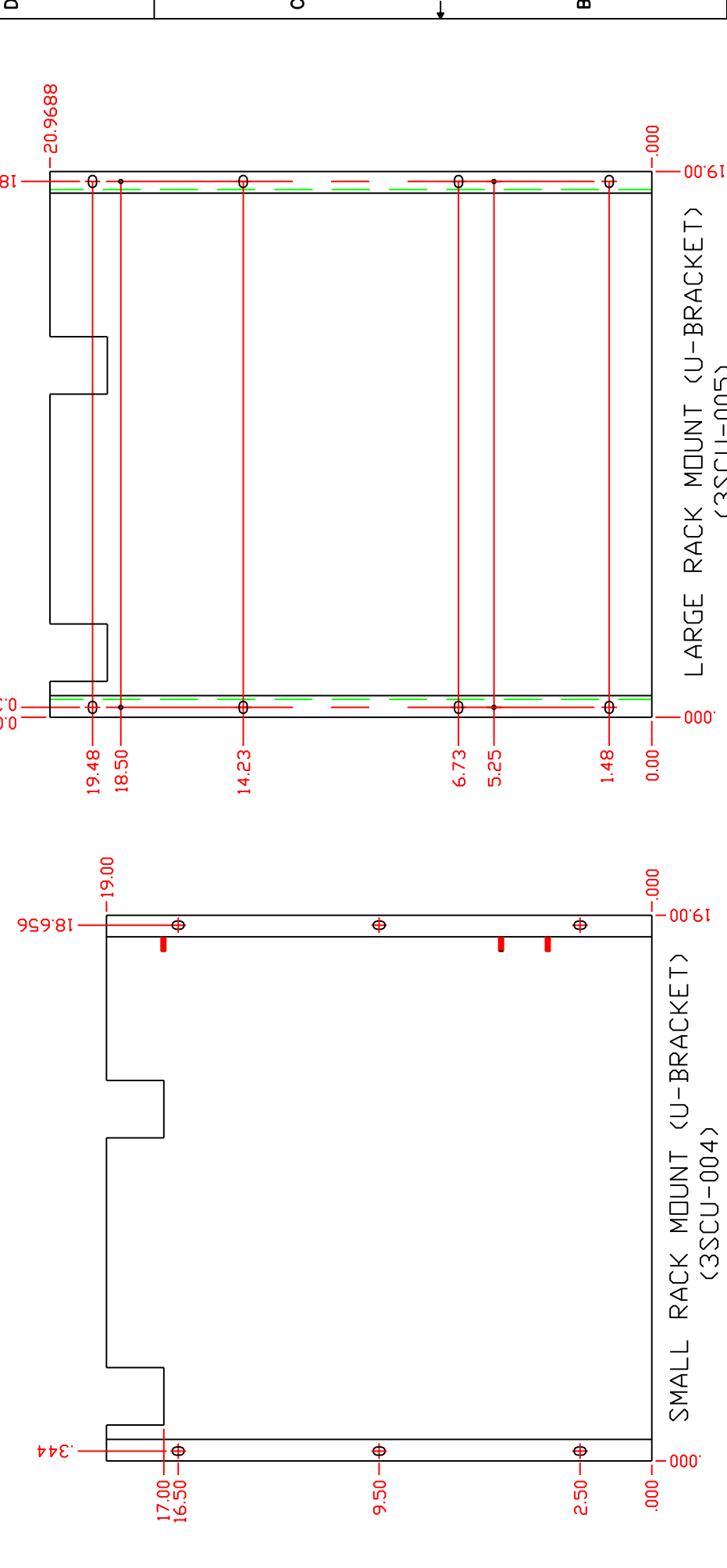
ITEM	QTY	DESCRIPTION	MANUF.
USED	MODEL NUMBER:		
FOR:	DESCRIPTION:		
RAW	DATE		
APV:	DATE		
MATERIAL	PART DESCRIPTION		
FINISH	MODEL 4S-8210-9ECD2		BALDWIN, INC.
DESIGN DIMENSIONS ARE IN INCHES	SCALE		
( ) DENOTES MILLIMETER EQUIVALENTS WHEN USED	B 1/4		
	4S-8210-9ECD2		
	QTY. DRG. S:\SAMPWMS\SM CON. SYSTEMS\DWG\		
	SHEET 1 OF 1		

**UNLESS OTHERWISE SPECIFIED:**  
 1. DIMENSIONS ARE IN INCHES  
 2. DECIMALS TO 0.02  
 3. PLACE = ± 0.010  
 4. HOLE = ± 0.007-0.01

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BRACKET	MODEL C	MODEL C1	MODEL CD	MODEL CD2	MODEL 5
SMALL	M115	M325	M425	M425	
LARGE		5210, 8210	5210, 8210	8210	545, 10410



ITEM	QTY	DESCRIPTION	MANUF.
USED FOR:	MODEL NUMBER:		
DESCRIPTION:			
DATE:	DATE:		
06/19/02			
<b>BALDWIN, INC.</b>			
PART DESCRIPTION			
SAMPLE CONDITIONER RACK MOUNT MOUNTING DIMENSIONS			
SIZE SCALE: DRAWING/PART NO.:			
A 3/16 RACK MOUNT			
CAD DIR: S:\36M\DWG\S-C-SYSTEMS\WALL MOUNT\SHEET 1.DF 1			

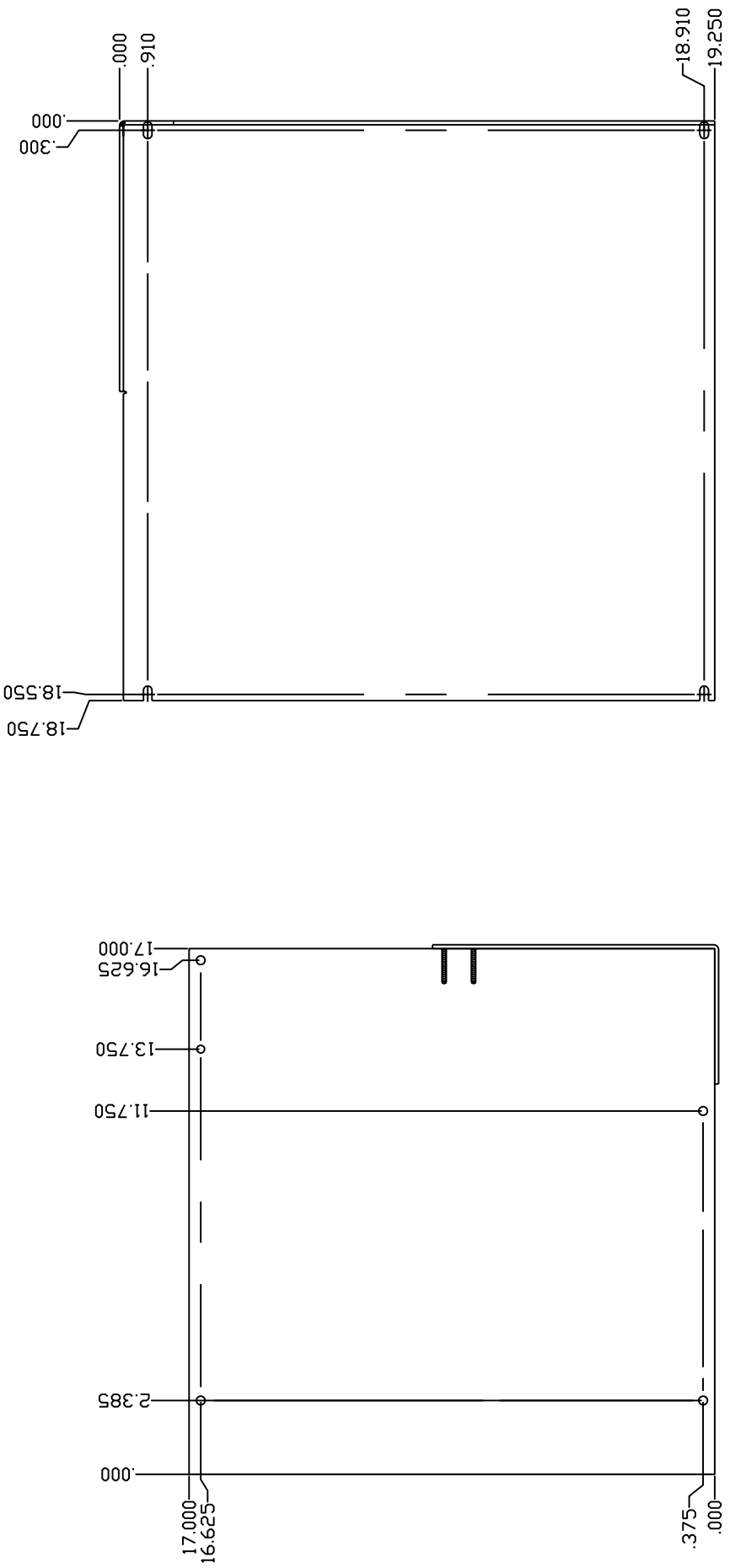
  

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------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------

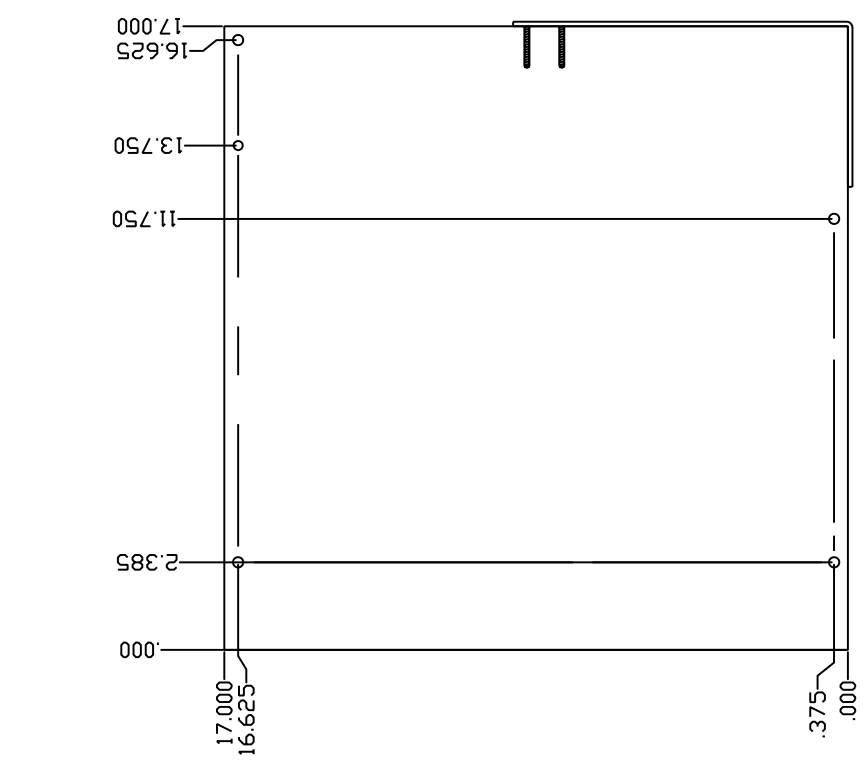
<p>UNLESS OTHERWISE SPECIFIED</p> <p>TOLERANCE DECIMALS</p> <p>1 PLACE = ±.02</p> <p>2 PLACE = ±.02</p> <p>3 PLACE = ±.010</p> <p>ANGLES = ±5°</p> <p>HOLES = ±.0037-001</p> <p><b>BALDWIN</b></p> <p>www.baldwinUSA.com</p>	<p>FINISH AS NOTED</p> <p>AS NOTED</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------

REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	JD	



LARGE WALL MOUNT (FLAT PLATE)  
(3SCP-001)

REV#	DATE	DESCRIPTION	DRAWN	APPROVED
0	00/00/00	INITIAL DRAWING	JD	



SMALL WALL MOUNT (FLAT PLATE)  
(3SCP-002)

BRACKET	MODEL C	MODEL C1	MODEL CD2	MODEL 5
SMALL	M115	M325	M425	
LARGE		5210, 8210	8210	545, 10410

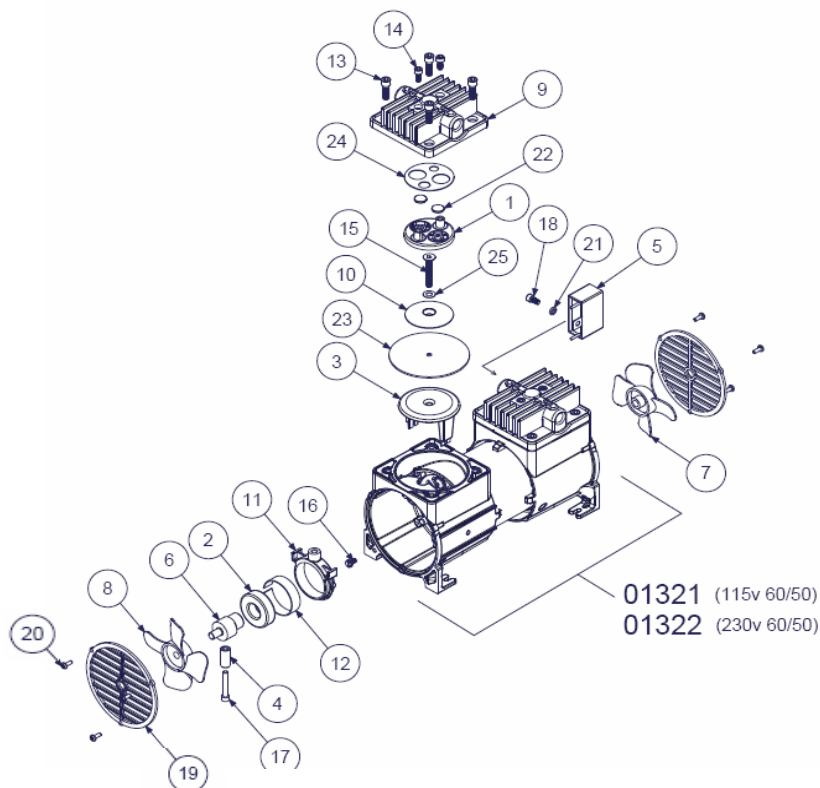
ITEM QTY		DESCRIPTION		MANUF.	
USED	MODEL NUMBER:	DESCRIPTION:			
FOR:	DATE:	DATE:			
DATE:	DATE:	DATE:			
MATERIAL		PART DESCRIPTION		BALDWIN, INC.	
AS NOTED		SAMPLE CONDITIONER WALL MOUNT MOUNTING DIMENSIONS		DRAWING/PART NO.:	
FINISH		SIZE		SCALE:	
AS NOTED		A		3/16	
DESIGN DIMENSIONS ARE IN INCHES		WALL MOUNT		SHEET 1 OF 1	
() DENOTES MILLIMETER EQUIVALENTS WHEN USED		CAD DIR: S:\56M\DWG\S-C-SYSTEMS\WALL MOUNT			

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UNLESS OTHERWISE SPECIFIED	SPACE FRACTIONS
TOLERANCE DECIMALS	OR
1 PLACE = ±.02	
2 PLACE = ±.01	
3 PLACE = ±.005	
ANGLES = ±5°	
HOLES = ±.0037-001	

## **Appendix D: 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 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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