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# Autosamdri<sup>®</sup>-815, Series A Overview

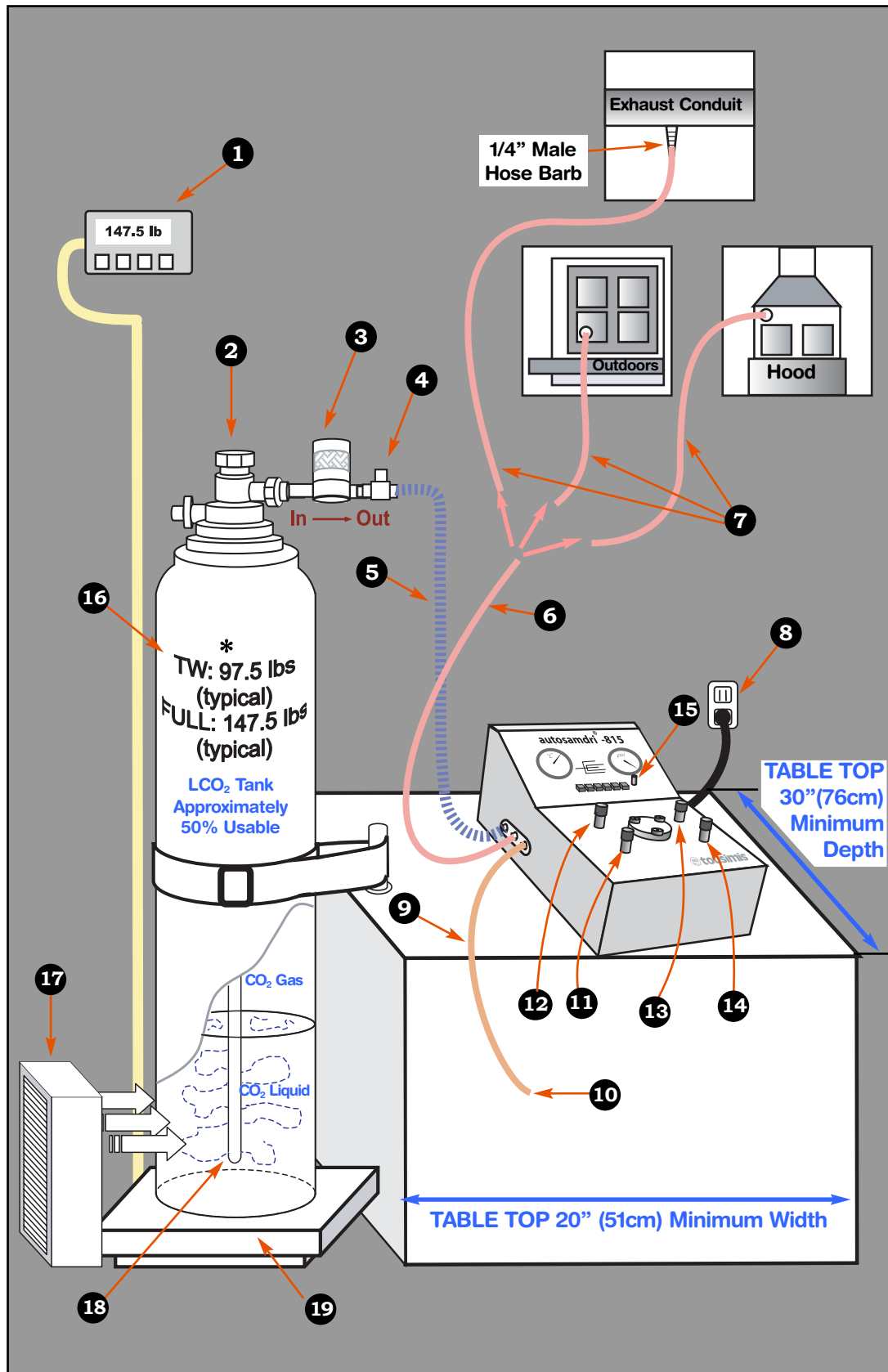
**THE FULLY AUTOMATIC AUTOSAMDRI<sup>®</sup>-815, Series A**



*tousimis<sup>®</sup> Catalog #8779B (Autosamdri<sup>®</sup>-815, Series A)*

## Autosamdri®-815, Series A Setup Overview

- 1 Remote LCD readout of LCO<sub>2</sub> Tank Weight
- 2 LCO<sub>2</sub> Cylinder ON/OFF Valve
- 3 External tousimis® Combination Filter (#8784)
- 4 T-Filter w/ 0.5µm Element
- 5 High Pressure Hose (5ft long, other lengths available upon request)
- 6 COOL / BLEED Exhaust Hose, White (1/4" ID), 6ft
- 7 COOL / BLEED CO<sub>2</sub> Exhaust Vented to either Hood, Exhaust Conduit, Outdoors, or Large Room
- 8 120V Properly Grounded Outlet (from Wall or Transformer)
- 9 PURGE / VENT Exhaust Hose, Clear (1/4" ID), 6ft
- 10 PURGE/VENT Exhaust Hose routed to either a Carboy (1 gal minimum) an Erlenmeyer Flask or Solvent Drain (if available)
- 11 FILL Meter Valve
- 12 COOL Meter Valve
- 13 BLEED Meter Valve
- 14 PURGE/VENT Meter Valve
- 15 PURGE TIMER
- 16 Tare Weight Varies (Consult your LCO<sub>2</sub> supplier or usually stamped on tank)
- 17 Ceramic Heater or Heater Jacket maybe required in a cold tank placement position
- 18 Syphon(Dip) Tube
- 19 LCO<sub>2</sub> Tank Scale (trc# 8770-54)



\* At Room Temperature (20°C - 24°C), average LCO<sub>2</sub> tank pressure is 800psi (+/- 5%).

# Installing Autosamdri<sup>®</sup>-815, Series A

See Appendix C (p.30), to Install Autosamdri<sup>®</sup>-815 with optional SOTER<sup>™</sup> Condenser (# 8777)

## PREPARATION OF INSTALLATION SITE

Upon receipt of your Autosamdri<sup>®</sup>-815, unpack the instrument carefully and check for any damage that may have occurred during shipment. Report (by Email [trc@tousimis.com](mailto:trc@tousimis.com) or Fax #301-881-5374) any irregularities immediately to tousimis<sup>®</sup>.

Insist on clean surfaces. Minimum table top space of approximately 20"(51cm) Width x 30"(76cm) Depth should be allotted for the Autosamdri<sup>®</sup>-815 with an additional 12"(31cm) x 12"(31cm) of floor space for the LCO<sub>2</sub> tank scale (See p.3).

- Use bone-dry (min. 99.8% Purity) LCO<sub>2</sub> with a syphon (dip-tube) tank\* only.
- Do not use pressurized LCO<sub>2</sub> with Helium or any other high pressure substitute gas.
- Properly secure LCO<sub>2</sub> tank according to your facility's safety protocol.

Tank pressure typically reads 800psi (±5%) at room temperature. The amount of LCO<sub>2</sub> in tank is best monitored with a LCO<sub>2</sub> tank scale (See accessories p.22).



- Always order LCO<sub>2</sub> tanks with Siphon or dip tubes.
- Air Gas refer to 99.8% purity grade as Bone Dry.
- Minimum LCO<sub>2</sub> purity required is 99.8%.

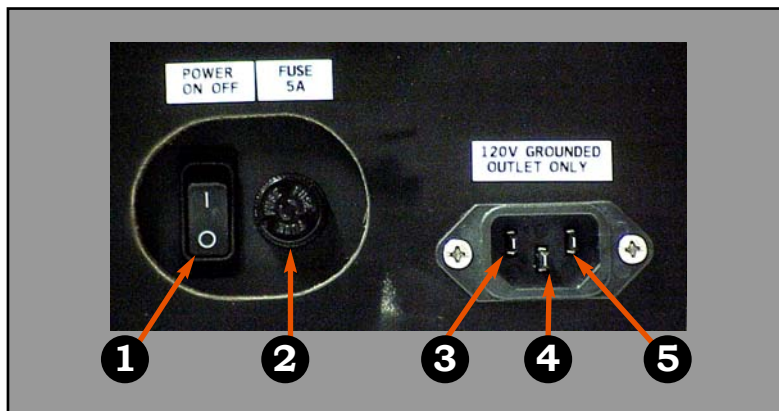
### Typical nominal LCO<sub>2</sub> tank weights for Net 50lb LCO<sub>2</sub> tanks:

- Full tank: 140 to 170 lbs / Tare of tank: 90 to 120 lbs.
- Most of the time, you may use 50% of a 50lb. net weight CO<sub>2</sub> tank.
- It is good practice to have spare LCO<sub>2</sub> tanks stored in reserve in case a tank runs out during mid process.

A properly grounded 120V/50-60Hz outlet should be located within 4ft (1.2m) of install site.

## Autosamdri<sup>®</sup>-815, Series A Power Panel

- 1 POWER ON / OFF SWITCH
- 2 FUSE 5 AMP (Bayonet Style Access)
- 3 AC (BLACK) HOT
- 4 GROUND 120AC/50-60HZ
- 5 AC (WHITE) NEUTRAL





\*\* LCO<sub>2</sub> tanks used in most facilities have tare weights ranging from 90 - 120lbs (40 - 55kg) and are delivered as "full" with net 50lbs (23kg) of compressed CO<sub>2</sub>.

Generally, 50% of the net LCO<sub>2</sub> is useable.

It is best to monitor the LCO<sub>2</sub> tank weight via a tank scale.

## INSTALLATION OF THE Autosamdri® -815

This Autosamdri®-815 is supplied with the basic accessories for operation with LCO<sub>2</sub> as a transitional fluid (for optional accessories, see p.22).

1. Install 815 within 4 feet (1.2m) of a properly grounded (120V/50-60Hz) electrical outlet.
2. Position a LCO<sub>2</sub> tank with dip tube within 5 feet (1.5m) of the 815. For a longer high pressure hose length, see p.22, trc #8770-33. The LCO<sub>2</sub> tank should be mounted on a 400lb (182kg) capacity floor scale w/ remote LCD<sub>2</sub> display (trc #8770-54) to easily monitor LCO<sub>2</sub> supply\*\*.
3. Pressure gauges or regulators should not be installed between the LCO<sub>2</sub> supply tank and the Autosamdri®-815 LCO<sub>2</sub> connect inlet. The stainless steel-sheathed high pressure hose accompanying the 815 is fitted with a CGA-320 female hex coupling which accepts a 3/4" plastic gasket (supplied) and joins the hose directly to the CGA-320 threaded male coupling at the tank top (See p.16). ALL LCO<sub>2</sub> tanks should be equipped with a rupture disc. All LCO<sub>2</sub> fittings and gasket surfaces should be kept clean and dry.

**NEVER OVER-TIGHTEN FITTINGS...TUBING ATTACHED MAY BE DAMAGED.**

## Connecting High Pressure Hose to Autosamdri®-815

4. Attach the HIGH PRESSURE HOSE onto the LCO<sub>2</sub> CONNECT INLET. Gently tighten the High Pressure Female Connector using the two open-end wrenches supplied (one on the hose and the other on the Inlet). Stop at the feel of first resistance; re-tighten if necessary, should you hear a leak.

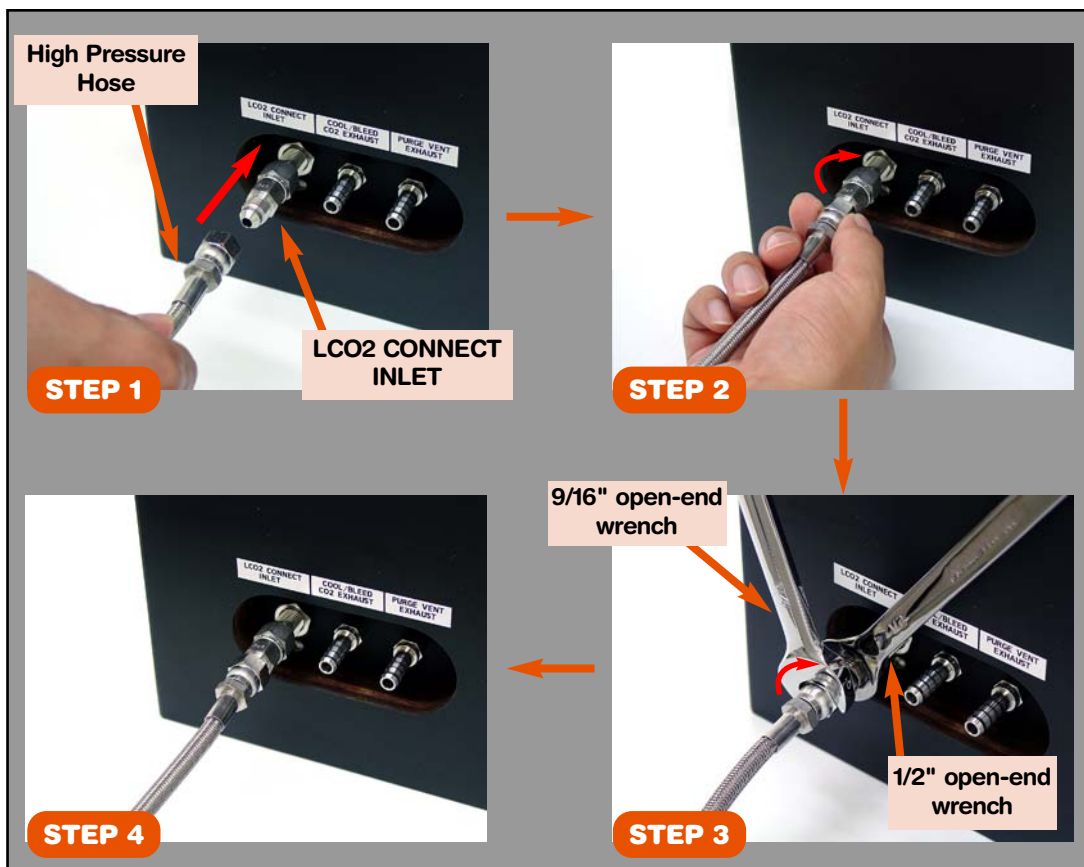


To attach LCO<sub>2</sub> high-pressure hose end fitting to the 815 "LCO<sub>2</sub> Connect", use the supplied 9/16" and a 1/2" open-end wrenches.

First, slide 1/2" wrench over 1/2" fitting as shown in the photo. The 1/2" wrench will be used to hold the "LCO<sub>2</sub> Connect Assembly" steady as you gently tighten the high pressure hose end fitting snugly onto each of the flare connects with a 9/16" wrench.

**DO NOT OVER-TIGHTEN**

**NO TEFLON® TAPE NECESSARY**





5. The tousimis® oil-water-particulate combination filter (catalog #8784) is factory installed directly onto the high pressure hose (See p.16-17). This helps prevent sample contamination from oil, water and particulates. Change the #8784A filter element with every 500lbs (226.8kg) LCO<sub>2</sub> tanks changes. The secondary 0.5µm T-Filter element may be removed, ultrasonicated and reinstalled every 3 months.

### Connecting Exhaust Hoses to Autosamdri®-815

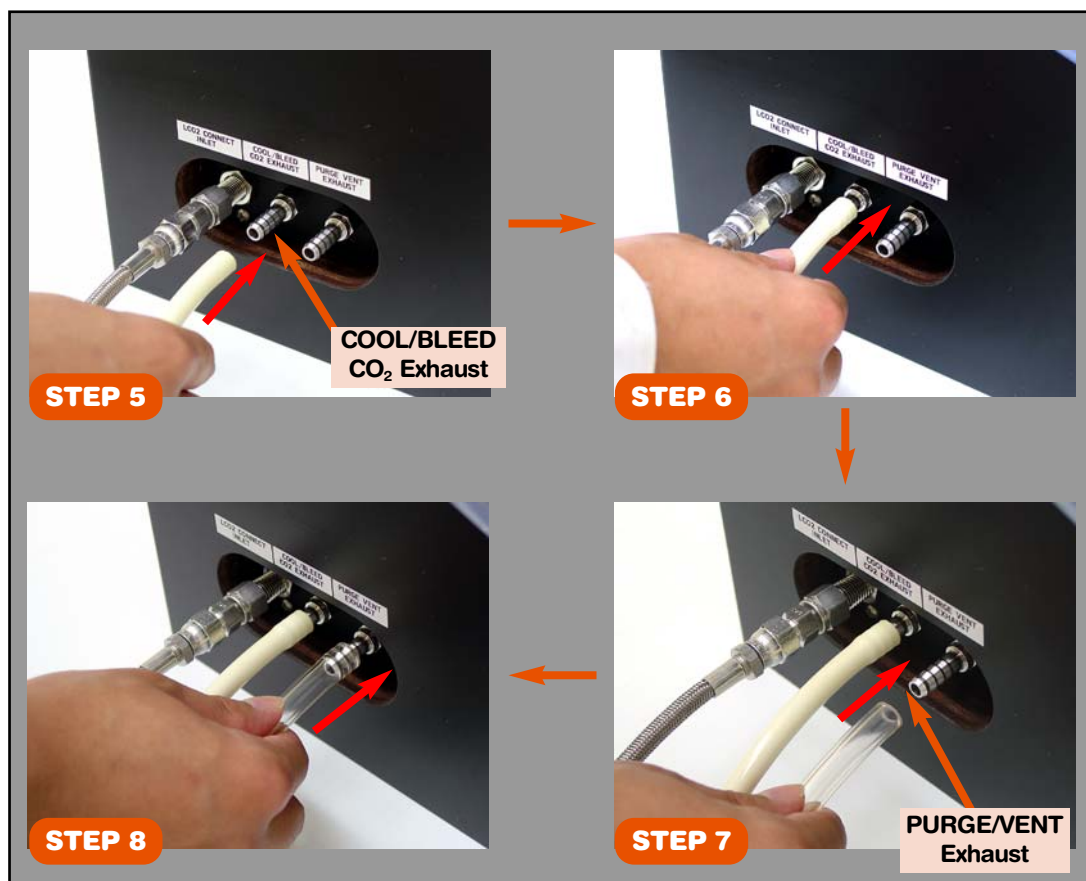
6. Attach the 6ft White COOL / BLEED Exhaust Tubing provided to the COOL / BLEED CO<sub>2</sub> Exhaust Outlet on the left-hand side of the Autosamdri®-815, and the 6ft Clear Exhaust Tubing to the PURGE / VENT Exhaust outlet (See photos above). The tubing should be free of kinks which could block passage of rapidly exiting noisy gas or solid flakes of CO<sub>2</sub>.



#### NOTE:

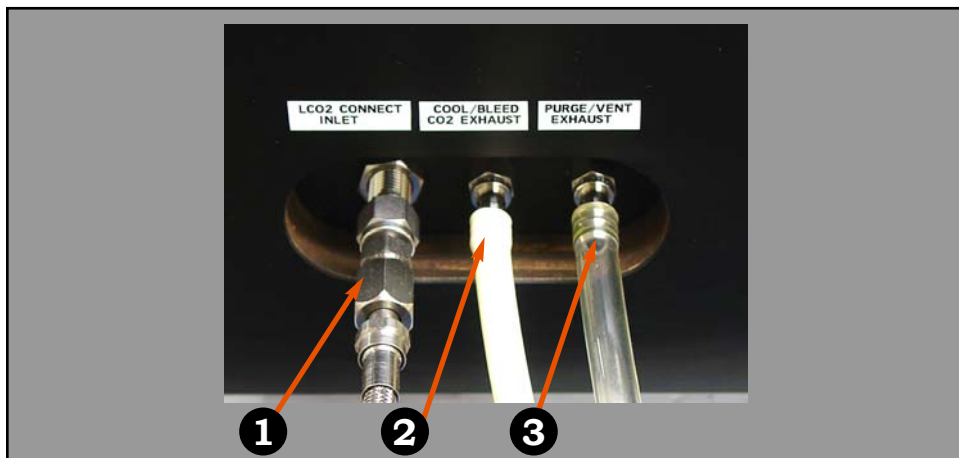
It is best to secure both the ends of the COOL/BLEED and PURGE/VENT Exhaust tubing so that the ends do not move during exhaust modes.

Be careful not to obstruct exhaust hose I.D. when securing.



## Samdri®-815 Complete Inlet / Outlet Setting

- 1 LCO<sub>2</sub> Connect Inlet
- 2 COOL / BLEED CO<sub>2</sub> Exhaust
- 3 PURGE / VENT Exhaust



## Samdri®-815 Chamber O-Ring



### NOTE:

The chamber O-Ring should lie completely in its groove.

NEVER grease the O-Ring.



### NOTE:

Do not expose chamber to HF or any other Acids.

Do not use Acetone.

Please consult tousimis before using any non-recommended intermediate fluids or process any non-traditional CPD application material(s)

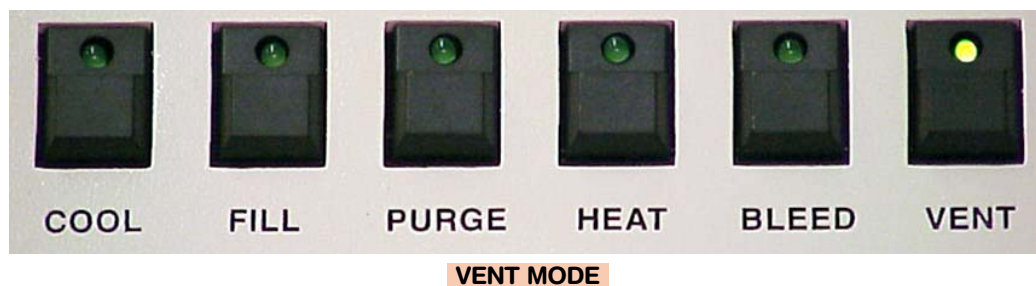
7. Check chamber, O-ring and windows; inspect unit to insure it is free of dust, oil and moisture. Chamber O-ring is NOT to be greased, but keep the chamber groove clean and dry.



**BE SURE TO KEEP CHAMBER O-RING GROVE AND FACE CLEAN AND DRY AT ALL TIMES.**

# Operating Autosamdri<sup>®</sup>-815, Series A

1. Turn power switch "ON". "ON/OFF" power switch is located on right side panel (See p.4). Green LED on VENT button will illuminate. This indicates the power is ON and the unit is "Standing By" in the VENT mode.



2. Let 815 stand for 3-5 minutes. This initial wait period will allow all internally heated plumbing components to "warm-up".

3. All metering valves (INLET, COOL, BLEED, PURGE/VENT) have been factory preset. There is no need to adjust Metering Valves. Open the main LCO<sub>2</sub> tank valve. The Syphon (dip-tube) LCO<sub>2</sub> tank should have between 25 lbs - 50 lbs (13.6 kg -23 kg) net weight of LCO<sub>2</sub>. (Subtract the tare weight of the tank from the tank weight to get the net weight of LCO<sub>2</sub>). Pressure measurement is no indication of the amount of LCO<sub>2</sub> left in the tank, as the same "psi" reading may be noted even after the liquid CO<sub>2</sub> drops below the level of the syphon tube.



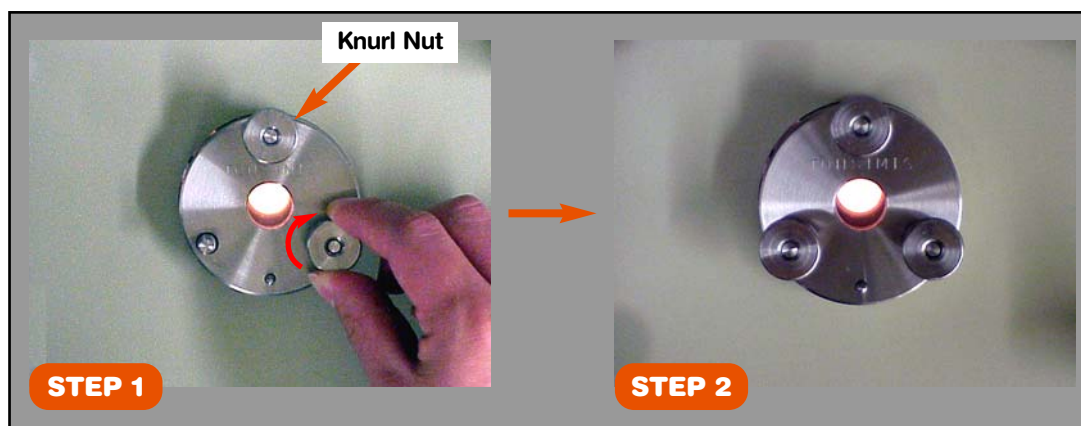
### NOTE:

\* Use Ultrapure Alcohols only! (i.e. I.P.A., Methanol, Ethanol).

Use minimum 99.5% purity Alcohols for best results.

4. Sample should be dehydrated completely in high purity (99.5+% minimum purity) alcohol. Pour sufficient alcohol into process chamber (Typically 10-15ml). Now, transfer the sample holder into the open process chamber. Make the transfer quickly in order to avoid the samples' exposure to air and moisture. The chamber O-ring should lie completely in its groove. NEVER grease the O-Ring. Place the chamber lid down over the chamber using the 3 knurl nuts; tighten each by hand with

## Secure Chamber





equal pressure. Never use channel locks or pliers for tightening the knurl nuts. Always hand tight!

5. Once the chamber lid is secured, it is time to set the PURGE timer located to the right of the push button switches (See picture below). Positions on the purge timer are calibrated at 5-minute intervals. Setting the “purge timer” indicator arrow to the #1 position will give you a 5-minute purge time. The #2 position will give you a 10-minute purge time... Correspondingly, the #9 position will give you the maximum purge time capable of 45 minutes.

*The “purge time” setting is best determined by the individual process engineer. General Purge Time guidelines for various chamber alcohol levels within the 815 are the following:*

- ¼ chamber = 5 minute purge time.
- ½ chamber = 7 minute purge time
- ¾ chamber = 10 minute purge time

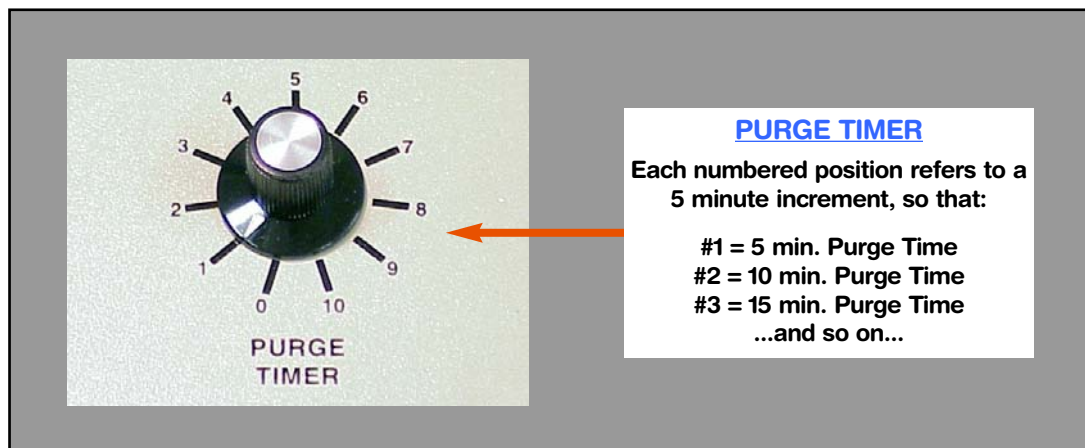
## Setting Purge Timer



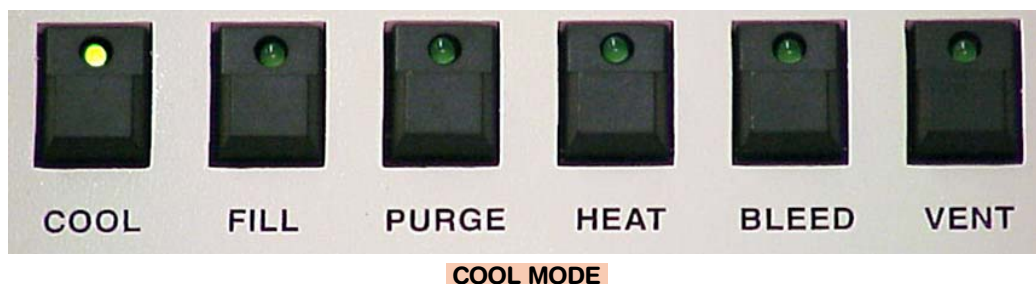
### NOTE:

Actual PURGE TIME may vary depending upon sample type and Alcohol Volume.

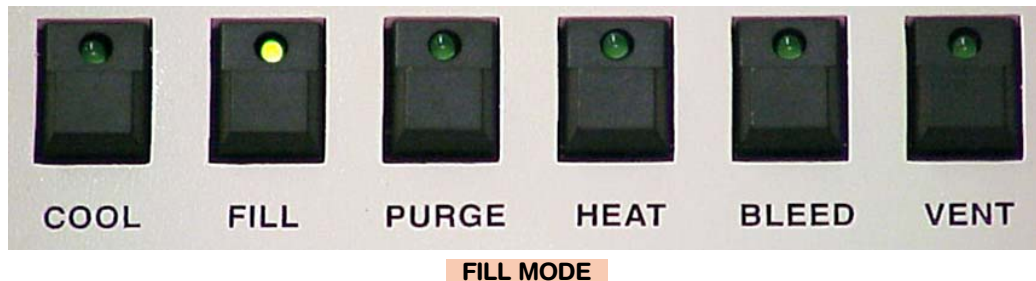
Typically a 10 minute PURGE TIME is sufficient for the majority of sample types.



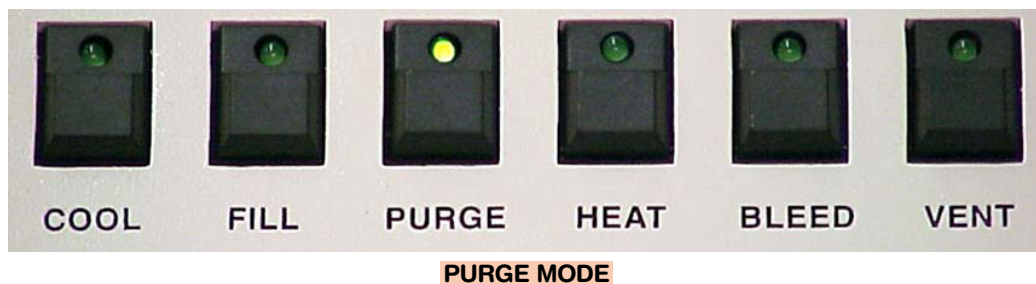
7. After initial warm up, press the COOL button. The COOL LED light will go on, and the VENT light will turn off. As the chamber temperature slowly begins to drop, you may hear the LCO<sub>2</sub> circulating through the unit. The 815 will continue cooling by itself until the chamber temperature reaches 0°C (±5°C). At this cut off point, the cooling will automatically stop.



7. Press the FILL button and the 815 will begin to fill the chamber with LCO<sub>2</sub>. *From this point forward, the Autosamdri®-815, Series A will automatically advance through all process modes sequentially until completion.* During the FILL mode, the LCO<sub>2</sub> will enter and fill the chamber for 2 minutes. You may hear the COOL cycle ON/OFF during the FILL mode as the chamber temperature is automatically maintained below 10°C.

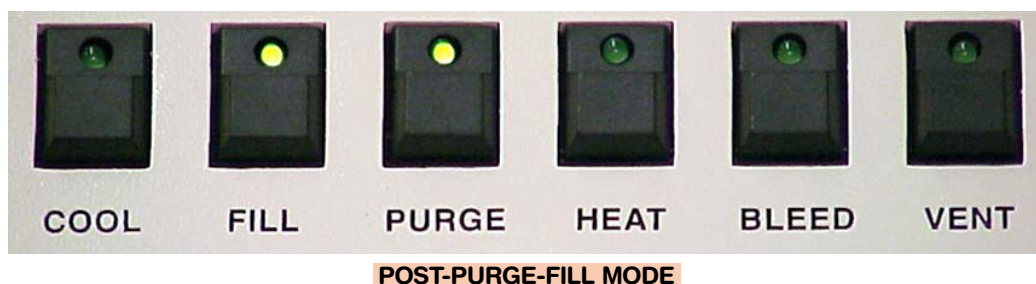


8. After the 2 minute FILL mode expires, the 815 will automatically advance into the PURGE mode. This will be indicated by the illumination of the PURGE LED.

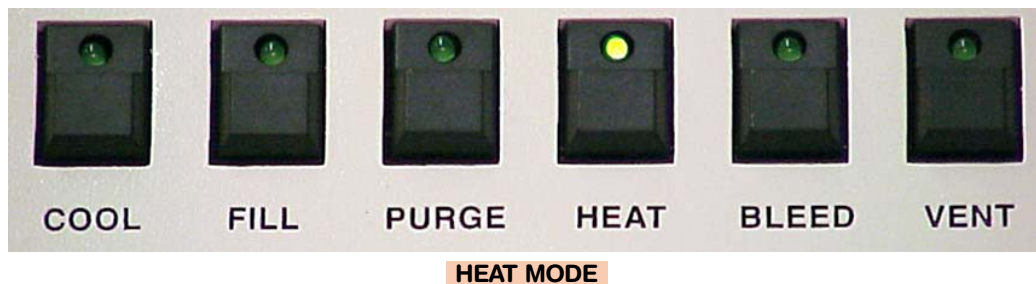


9. At this point of the cycle, the 815 will remain in the PURGE mode for the duration of time pre-set by the operator via the PURGE TIMER (See p.9). The waste alcohol will exit the 815 Chamber via the PURGE / VENT Exhaust line.

10. Upon Completion of the PURGE mode, the unit will automatically advance into a POST-PURGE-FILL mode in which the chamber fills with LCO<sub>2</sub> for an additional 2 minutes. This mode is indicated by both the FILL and PURGE LED's illumination.



11. Upon completion of the POST-PURGE-FILL mode, the PURGE and FILL LEDs will turn off and the HEAT LED will illuminate. The HEAT mode is the stage in which the samples are carried through the “*Critical Point*”. Both the pressure and temperature will steadily rise. (See Check-Out Data Sheet in the appendix of your 815 User Manual)

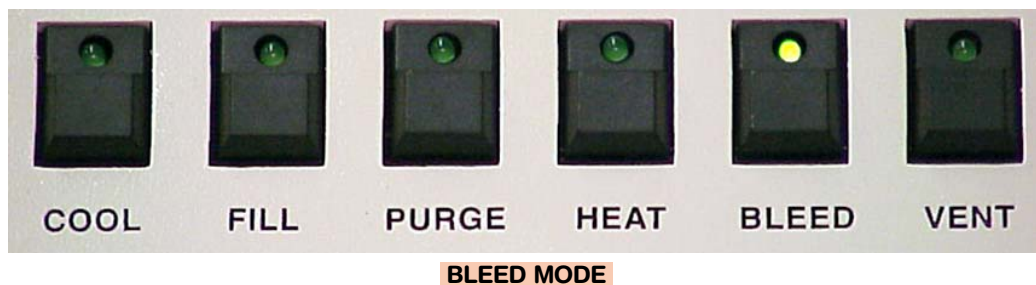


12. When the chamber pressure reaches and goes beyond 1072 psi, it will stabilize in the neighborhood of 1350psi ( $\pm 5\%$  @ 20°C). As the temperature achieves 31°C, the unit has achieved the “critical point” and this is where the ‘*tousimis equilibrium*’\* cycle starts. The HEAT LED will begin to blink for the next 4 minutes indicating your 815 is in the ‘*tousimis equilibrium*\*’.



\* 'tousimis equilibrium' is the point during the critical point passage in which both the pressure and temperature are maintained above the critical point within the chamber for a period of 4 minutes prior to advancing into the BLEED mode.

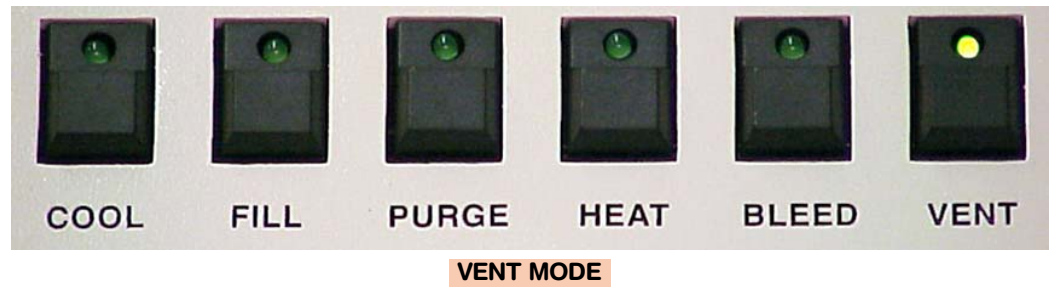
13. At the end of the ‘*tousimis equilibrium*’ period, the 815 will automatically advance into the BLEED mode. The HEAT LED will stop blinking and the BLEED LED will illuminate.



14. At this point, you can measure the BLEED rate (if desired) via the Flow Meter supplied, by attaching the Flow Meter to the outlet of the COOL / BLEED CO2 EXHAUST. The BLEED rate has been factory pre-set to decompress the chamber at a rate of 100-150psi/min.

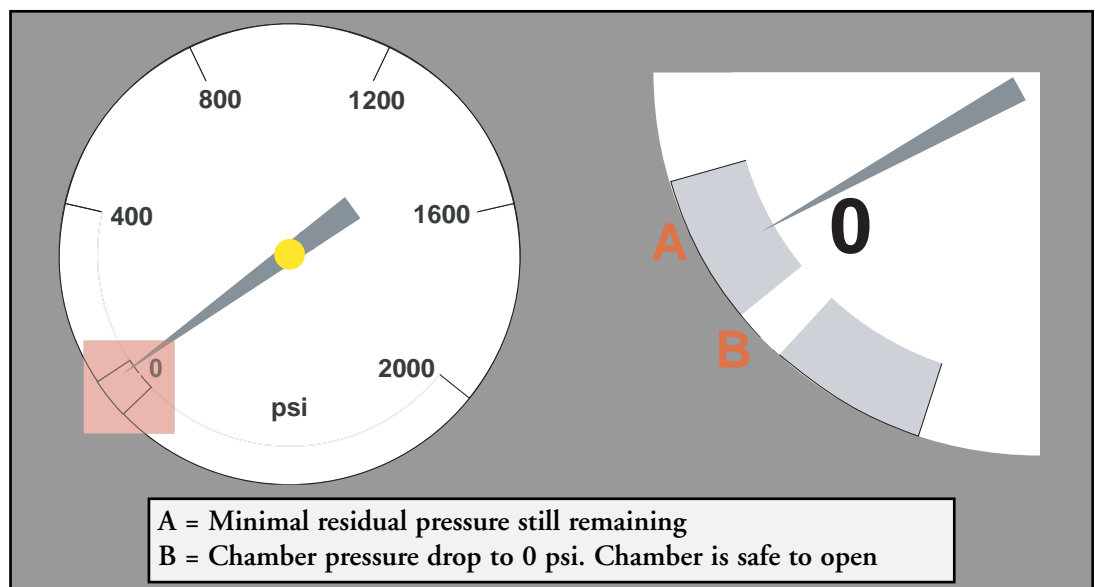
The flow rate should read 8-10 SCFH at the onset of the BLEED mode. This setting should yield an average decompression rate of approximately 100-150psi/min reduction in pressure. This pressure reduction flow rate is the desired decompression rate between 1300psi to 400psi.

15. At approximately 360-400 psi, the 815 will automatically advance from BLEED mode into the VENT mode. The BLEED LED will turn off, while the VENT LED will illuminate.



16. It is not necessary to readjust the PURGE-VENT metering valve flow rate. The chamber should then come to atmospheric pressure in approximately 3 minutes in this VENT mode.

### Pressure Gauge (0 psi)



17. At this point, the chamber lid may be removed by alternatively and evenly loosening the knurl nuts (Pressure Gauge should be in the 0 psi range, Never attempt to 'force' opening).

18. The sample(s) can then be removed from the chamber for further processing. Seal the chamber with the lid to help keep it clean and moisture free.

19. Turn the 815 power off using the ON/OFF SWITCH located on the right-hand side of the tool (See p.4). You will notice that it will take a few seconds for the VENT LED to turn off.

20. Turn LCO<sub>2</sub> main tank ON/OFF valve OFF in a "Clockwise Rotation" if desired for additional safety precaution.

Illustrations

Metering Valve w/ Vernier Handle Setting Example



The numerical markings are arbitrary numerals for the sole purpose of meter valve adjustment position reference.

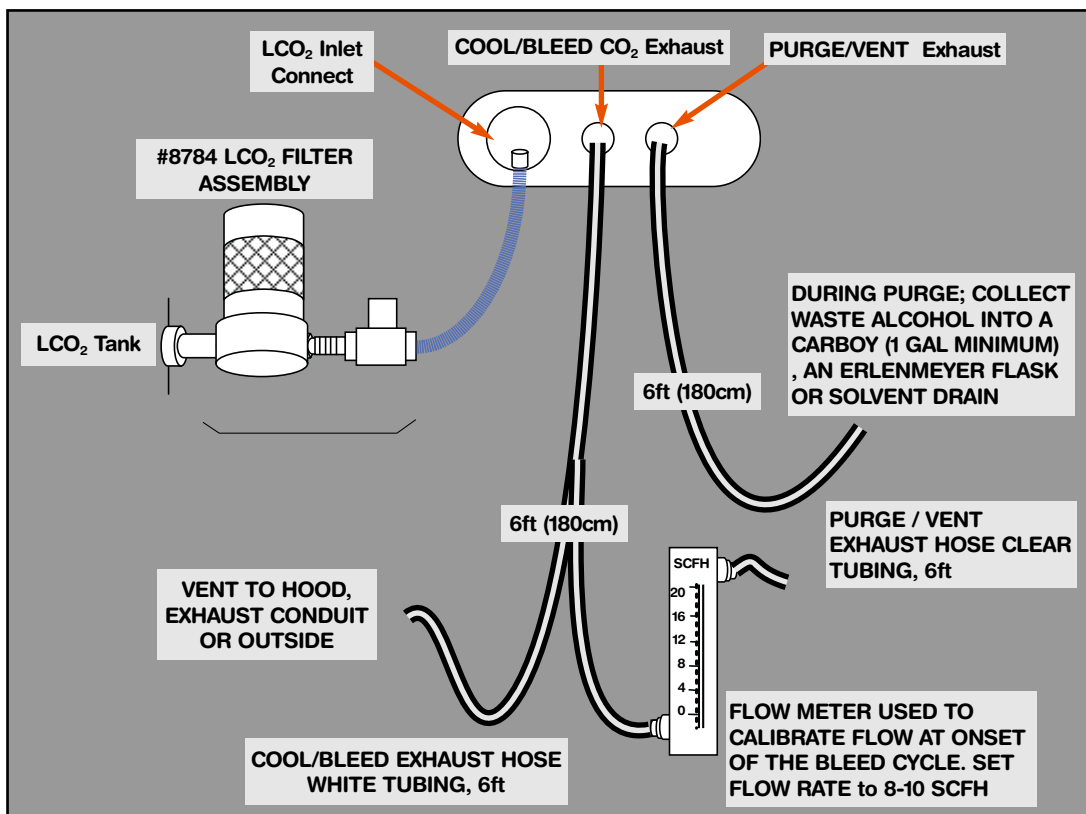
1 complete counter-clockwise 360 rotation from the 0.00 starting position is referred to as the '0.25 position'.



Venting Precautions



Only use Flow Meter to measure flow at onset of BLEED mode only.





# Maintenance and Support

## Regular Maintenance Schedule

Maintenance Activity	Recommended Frequency	Manual Reference	trc® Catalog Number
Keep Chamber Clean and Dry	Always	p. 15	N/A
Replace LCO <sub>2</sub> Tank	After 50% net tank consumption	p. 19 (FAQ)	Contact local supplier
Replace LCO <sub>2</sub> Oil/Water Filter on LCO <sub>2</sub> Filter Assembly	500lb LCO <sub>2</sub> Use	p. 16-17	# 8784A
Replace T-Filter Element on LCO <sub>2</sub> Filter Assembly	1 Year*	p. 18	# 8770-83B
Chamber O-Ring	3 Months*	p. 7	# 8770-51
Internal Purge Line 0.5µm Filter	6 Months*	p. 28-29	# 8770-83
* May Vary Depending on Usage..			

Chamber Care



**NOTE:**  
\* Use Ultrapure Alcohols only! (i.e. I.P.A., Methanol, Ethanol).

Use minimum 99.5% purity Alcohols for best results.



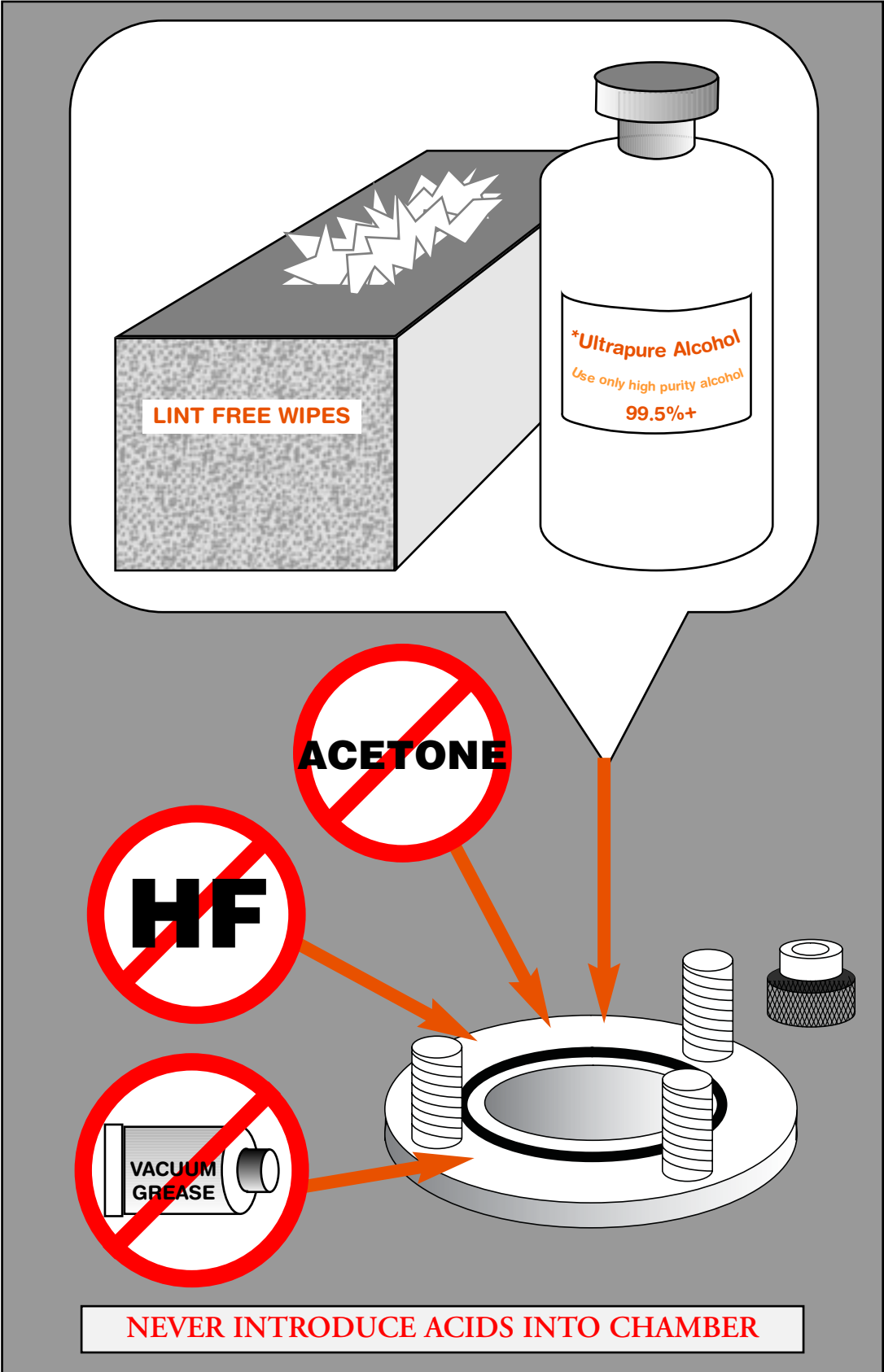
**NOTE:**  
Do not expose chamber to HF or any other Acids.

Do not use Acetone.

Please consult tousimis before using any non-recommended intermediate fluids or process any non-traditional CPD application material(s)



**NOTE:**  
BE SURE TO KEEP CHAMBER O-RING GROVE AND FACE CLEAN AND DRY AT ALL TIMES.



## LCO<sub>2</sub> Filter Assembly

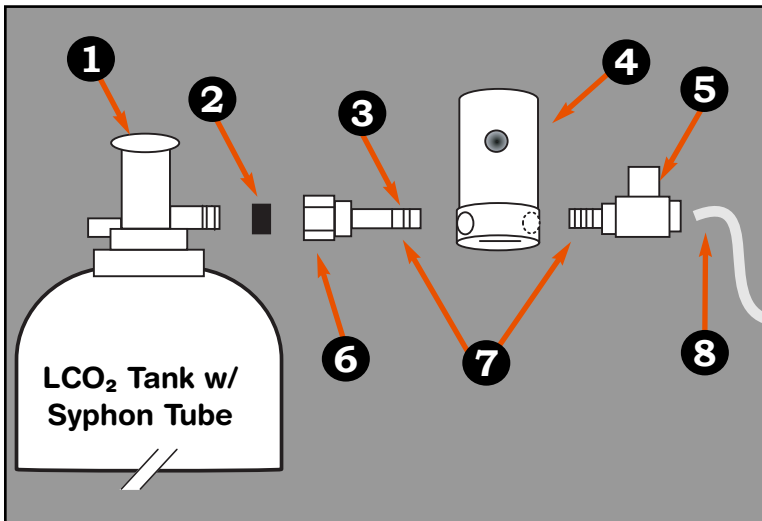
THE tousimis® LCO<sub>2</sub> FILTER ASSEMBLY (# 8784)

( 4 + 5 Figure Shown Below)

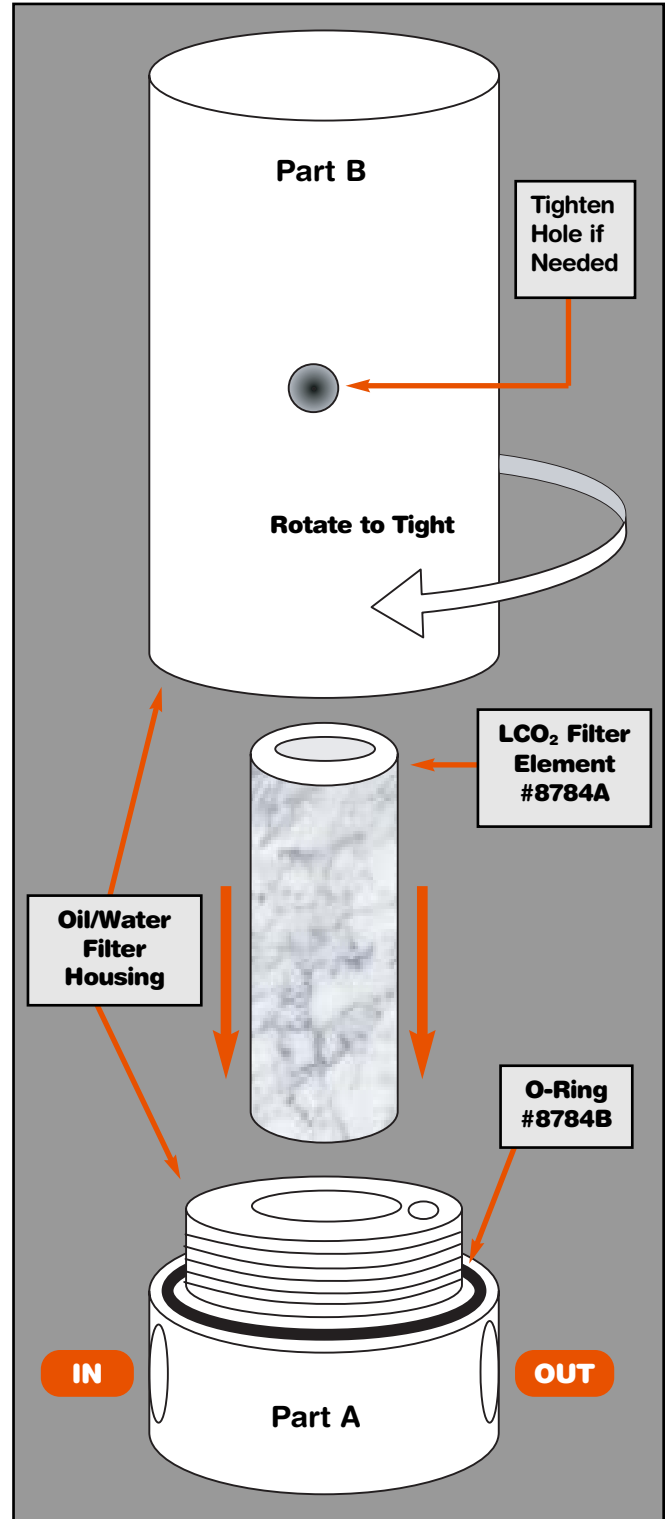
### Installation Instructions

1. Uncouple CGA-320 S.S. nut from LCO<sub>2</sub> tank. Close main tank valve. Crack S.S. nut and bleed line pressure. Make certain there is no pressure within the high pressure hose.
2. Install filter element as shown in the diagram. (#8784A) Push element steadily into upper housing orifice until slight resistance is felt. Screw housing (Part B) onto upper housing (Part A). Be sure that teflon® O-Ring is in place.
3. The 0.5 µm T-Filter Element (# 8770-83B) is pre-installed into T-Filter.

\* Change LCO<sub>2</sub> Filter Element (#8784A) with every 500 lbs of LCO<sub>2</sub> consumption, change T-Filter Element (#8770-83B) every 1 year to insure proper filtration.



- |  |  |
|--|--|
| 1 Main LCO <sub>2</sub> Tank Valve                                     | 5 T-Filter with T-Filter Element (0.5 µm, #8770-83B) |
| 2 Gasket (Teflon® or Nylon)  | 6 CGA - 320 S.S. Coupler Nut                         |
| 3 CGA - 320 S.S. Nipple  | 7 Teflon® tape                                       |
| 4 Oil/Water Filter Housing w/ LCO <sub>2</sub> Filter Element (#8784A) | 8 High Pressure Hose to Sandri®                      |



CAUTION: USE tousimis® LCO<sub>2</sub> FILTER ELEMENT (trc# 8784A) ONLY.

Operating pressure not to exceed 1000 psi

# LCO<sub>2</sub> Filter Assembly

**STEP 1**



After all of the pressure is safely bled from the high pressure line, unscrew #8784 housing by hand.

**STEP 2**



Remove housing.

**STEP 4**



Place new #8784A element into lower housing. Let gravity hold element in place.

**STEP 3**



Remove old element and position new element into center of lower housing.

**STEP 5**



Carefully lower filter housing over replacement element (#8784).

**STEP 6**



Hand tighten the housing body together firmly. O-Ring seats properly. Open main tank valve and check for leaks.

## LCO<sub>2</sub> T-Filter Element Installation (#8770-83B)

### STEP 1



After all of the pressure is safely bled from high pressure line, unscrew T-Filter cap using wrench.

### STEP 2



Carefully remove T-filter element.

### STEP 4



Top view of correctly installed T-Filter.

### STEP 3



Install a new T-filter element (#8770-83B) into center of T-filter housing.

### STEP 5



Hand tighten T-filter cap.

### STEP 6



Use wrench to tighten the T-filter cap firmly. Open LCO<sub>2</sub> tank valve and check for leaks.



**NOTE:**  
Do not over-tighten  
T-Filter Cap.



## FAQ

### Are the Metering Valves pre-set from the factory?

YES. All Metering Valves (See p.13) are factory set during the final check-out. However, should you wish to change the rate of flow, feel free to readjust the valves to suit your particular parameters. Keep in mind that the incoming LCO<sub>2</sub> into the chamber controlled by the FILL adjust; should always be greater than the outlet of LCO<sub>2</sub> (controlled by the PURGE / VENT adjust) during the PURGE mode.

The BLEED rate needs to average no more than 100-150 psi/minute in chamber pressure reduction. A Flow Meter has been provided for occasional BLEED rate adjustment.

### Do I need to open / close the Metering Valves?

NO. There is no need to “Close” or “Open” the Metering Valves. These functions are carried out by the Internal Solenoid Valves. The Metering Valves are only for adjusting the Flow Rate of LCO<sub>2</sub> or gaseous CO<sub>2</sub>.

### Should the LCO<sub>2</sub> tank be secured?

YES. It is recommended that:

The LCO<sub>2</sub> Tank be placed onto LCO<sub>2</sub> Tank Scales (trc #8770-54) and secured as per your facility safety regulations. Monitor the net LCO<sub>2</sub> used. When you approach 50% LCO<sub>2</sub> consumption, it is recommended that you replace the LCO<sub>2</sub> tank with a new one. Always keep several spare tank of LCO<sub>2</sub> in reserve.

### Do I need an In-line regulator between the tank and the Autosamdri®-815?

NO. A regulator is not needed between the LCO<sub>2</sub> tank and the 815. The 815 is designed to simply operate from LCO<sub>2</sub> direct tank pressure.

### Is the chamber automatically heated during BLEED mode?

YES. During the BLEED mode; the 815 will automatically stay in the HEAT mode. The chamber temperature will stay above 31°C and keep the process chamber dry.

### How do I replace the #8784A filter elements?

To replace #8784A filter element, loosen and remove lower part B by turning counter clockwise. Remove old element and replace with new (See illustration p.16-17).

### Why can I only use 50% of the net amount of LCO<sub>2</sub> and not 100% of the net LCO<sub>2</sub> within a new LCO<sub>2</sub> tank?

LCO<sub>2</sub> is lost during the process for 2 reasons:

- 1) As the liquid level drops in the LCO<sub>2</sub> tank, the gaseous head space created as the liquid level drops is taken up via gaseous CO<sub>2</sub> molecules.
- 2) Syphon (aka: dip-tubes) does not reach the absolute bottom of the LCO<sub>2</sub> tank.

### Is a syphon or dip tube type LCO<sub>2</sub> tank necessary?

YES. It is essential that the LCO<sub>2</sub> tank has a syphon or dip tube on order to deliver liquid and not gaseous CO<sub>2</sub>. The Autosamdri®-815, Series A will not operate properly without liquid CO<sub>2</sub>.

### What grade LCO<sub>2</sub> is best for the Autosamdri®-815, Series A?

99.8% minimum purity.

### How do I secure the chamber lid?

Evenly finger-tighten the chamber lid with the 3 Knurled Nuts (See p.8). Use even and steady finger pressure on all Knurl Nuts alternatively. Never use a non compatible tool or excessive force (i.e.: never use a wrench, flyers, etc).

### Should I use “High-Pressure Head” tanks such as Helium or other high-pressure gases?

NO. Never use high-pressure tanks. Typical proper pressure range for LCO<sub>2</sub> tanks are between 750 – 900 psi. Higher pressures may damage Autosamdri®-815, Series A and / or cause failures.

### Can I use lower purity alcohol or acid in chamber?

NO. Only use ultrapure alcohol (Ethanol, Methanol, I.P.A., etc.) in chamber.  
NEVER USE ANY ACID!  
Contact tousimis prior to using any other intermediate liquids.

### What should I do if all the LED's begin to blink during a process run?

This indicates a CRITICAL POINT PASSAGE FAILURE due to either non-sufficient temperature or pressure. Typically this results from LCO<sub>2</sub> running out mid process. Turn “Chamber Power” OFF. Replace empty LCO<sub>2</sub> cylinder with a new tank, turn “Chamber Power” back ON and initiate new run as per normal.

### Is chamber pressure automatically regulated during Critical Point Passage?

YES. Chamber pressure will rise above 1072psi (Critical Pressure for CO<sub>2</sub>) and automatically vent internally at 1350psi ±5% @ 20°C.

### Is there back-up pressure Safety?

YES. In addition to automatic internal pressure venting above the Critical Point. There is a “rupture disk” in series which automatically vents entire system at 2000psi.

### May I replace or add parts without authorization from tousimis®?

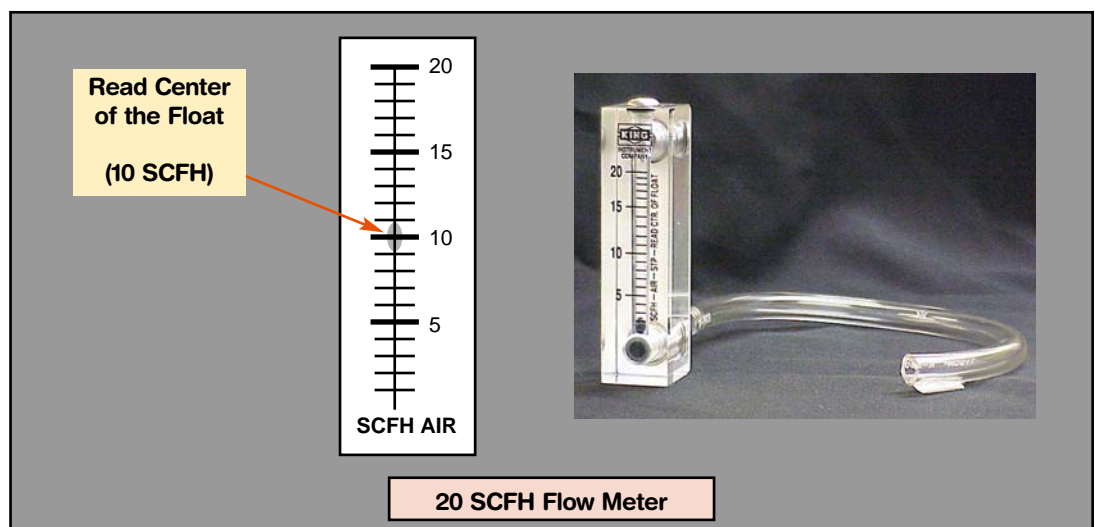
NO. Autosamdri®-815, Series A is a high pressure instrument with specific tolerances engineered into the design. Please contact tousimis® for authorization prior to attempting any desired changes via tel. #301.881.2450 or email at techsupport@tousimis.com.

## What can I do to check that the BLEED rate is properly set should it appear unusually slow?

The flow rate should read 8 - 10 SCFH at the onset of the BLEED mode. This setting should yield at average of approximately 100-150 psi/min reduction in pressure. This pressure reduction flow rate is the desired decompression rate between 1300 → 400 psi to avoid condensation.

You may periodically measure the BLEED rate (if desired) via the Flow Meter supplied by attaching the Flow Meter to the COOL / BLEED CO<sub>2</sub> Exhaust Outlet via a short (approximately 2') piece of Tygon tubing.

## 20 SCFH Flow Meter with 2 ft Tygon® Tubing



## What should I do if the initial COOL time is suddenly much slower than normal?

99% of the time the reason for this is lack of Liquid CO<sub>2</sub>. The SAMDRI® is designed to COOL the process chamber via Liquid CO<sub>2</sub> and not gaseous CO<sub>2</sub>.

Reasons that typically explain gaseous CO<sub>2</sub> delivery:

- 1) The Liquid CO<sub>2</sub> level has dropped below LCO<sub>2</sub> tank siphon (aka: dip tube) and only gaseous CO<sub>2</sub> is being delivered. [Note: The best way to monitor LCO<sub>2</sub> is via weight and not pressure. It is best to monitor tank weight via a "LCO<sub>2</sub> tank scale (trc#8770-54)"]
- 2) Gas supplier has delivered Gaseous rather than Liquid CO<sub>2</sub> by mistake. This can happen as the 2 tank types may look identical and the delivery/loading Gas Company staff accidentally delivered the wrong tank type to your site.

The simpler solution is to replace the existing supply tank with a new LCO<sub>2</sub> tank and initiate COOL mode. If the same problem persists; please contact customer service at either [techsupport@tousimis.com](mailto:techsupport@tousimis.com) or via tel# 301-881-2450.

## OPTIONAL ACCESSORIES

Catalog #	Description
8777	SOTER™ CONDENSER
8760-01	Knurl Nut
8760-40	5 AMP Fuse
8770-10	Lamp, 120V/60Hz volt
8770-32	High Pressure Hose, 5 ft
8770-33	High Pressure Hose, 10 ft
8770-HPS	High Pressure Hose, Custom Length Up To 10m (33ft)
8770-45	Flow Meter - Use with any 1.25" dia. Samdri® Chamber (20 SCFH)
8770-50	Chamber Lid
8784	LCO2 Filter Housing for 8784A Filter Element
8784A	Replacement LCO2 Filter Element for 8784 Filter Housing
8784B	O-Ring for 8784 Filter Housing Seal
8784-05	Gasket for LCO2 Tank Connect
8770-83	Internal 0.5µm Brass Particulate Line Filter
8770-51	O-Ring for 1.25" Diameter Autosamdri® Chamber
8770-53	Power Cable, three prong, 120V/60Hz
8770-54	LCO2 Tank Scale, w/ Remote LCD Display (400lb capacity)
8770-55	LCO2 Tank Heater
8770-56	Step-Down Transformer, 220V → 110V
8770-57	Step-Up Transformer, 100V → 120V, 50/60hz
8761	Grid Holder, holds 12 grids.
8762	12 Sample Holder, each compartment measures 7.5 (dia.) x 6mm (ht.)
8763	24 Sample Holder, each compartment measures 4.5 (dia.) x 6mm (ht.)
8764	4 Sample Holder, each compartment measures 9 (dia.) x 16mm (ht.)
8766	Cover Slip Holder, for 9mm to 13mm diameter Glass Cover Slips
8766-01	Washer for Glass Slip Holder (for use with #8766)
8766-02	Stainless Steel Screens for Cover Slip Holder (for use with #8766)
8767	Cover Slip Holder, for 16mm to 22mm diameter Glass Cover Slips
8767-01	Washer for Glass Slip Holder (for use with #8767)
8767-02	Stainless Steel Screens for Cover Slip Holder (for use with #8767)

Contact tousimis @ 301-881-2450 or [trc@tousimis.com](mailto:trc@tousimis.com) for current pricing and availability, or visit our web site at [www.tousimis.com](http://www.tousimis.com).

## WARRANTY

The Autosamdri®-815, Series A is warranted to the original purchaser for two years from date of purchase against any defect in materials or workmanship. Should you have any questions, please feel free to contact us. If it is determined that the unit should be returned for repairs to our Service Department, we will send a written authorization for shipment. Parts and labor are free of charge; shipping charges are to be paid by customer (insure instrument at current list price).

DO NOT ship instrument via U.S. Mail. Use UPS, FedEx or other qualified shippers only.

Our mailing address: **tousimis research corporation**  
2211 Lewis Avenue  
Rockville, Maryland 20851  
USA

Our shipping address: **tousimis research corporation**  
Attention: Instrument Service Department  
2211 Lewis Avenue  
Rockville, Maryland 20851  
USA

Telephone # 301-881-2450

Fax #301-881-5374

Email: [techsupport@tousimis.com](mailto:techsupport@tousimis.com)

## REPACKAGING FOR SHIPMENT

After authorization for repairs is received (see warranty), this general rule may be followed in repackaging a tousimis® instrument for shipment:

- a) Attach identification tag to instrument. Tag should indicate owner name, the model and 4-digit serial number of the instrument, and the type of the service or repair desired.
- b) Secure chamber lid over a properly seated O-ring and tighten 8-knurl nuts evenly. Do not send the high-pressure hose or electrical power cord.
- c) Place instrument in original container, if available. If original container and packaging material is not available, new packaging may be purchased from tousimis

If original container is not used,

- d) Wrap the instrument in bubble plastic.
- e) Protect panel faces and instrument sides with foam or appropriate non-abrasive cushioning material. Use a minimum 6" of shock-absorbing packing material around all points of the instrument. Two double walled boxes are suggested for shipment; BOX-WITHIN-A-BOX AT 350LBS. TEST STRENGTH.
- f) Use heavy duty shipping tape or metal bands to seal container.
- g) Mark shipping container with "Delicate Instrument, Fragile", etc. and insure it.



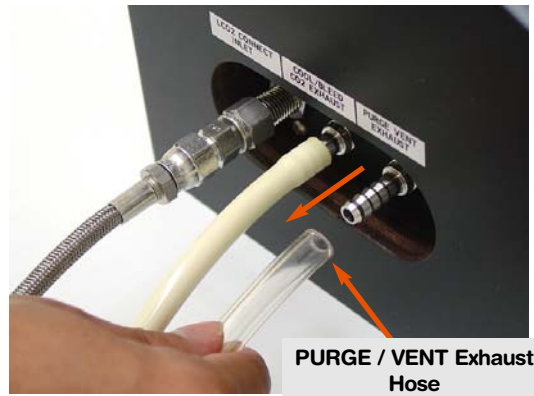


# Chamber Lamp Replacement Installation

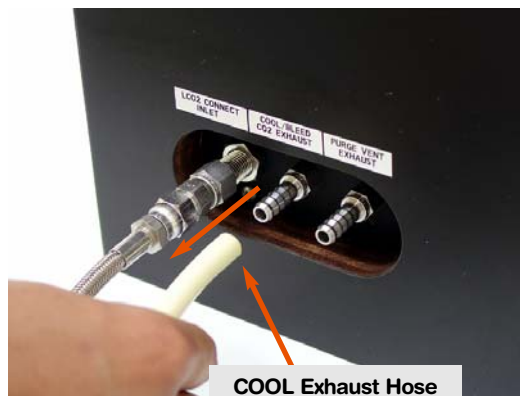
1. Turn the power switch "OFF" and unplug 120V power cord from the Autosamdri®-815.



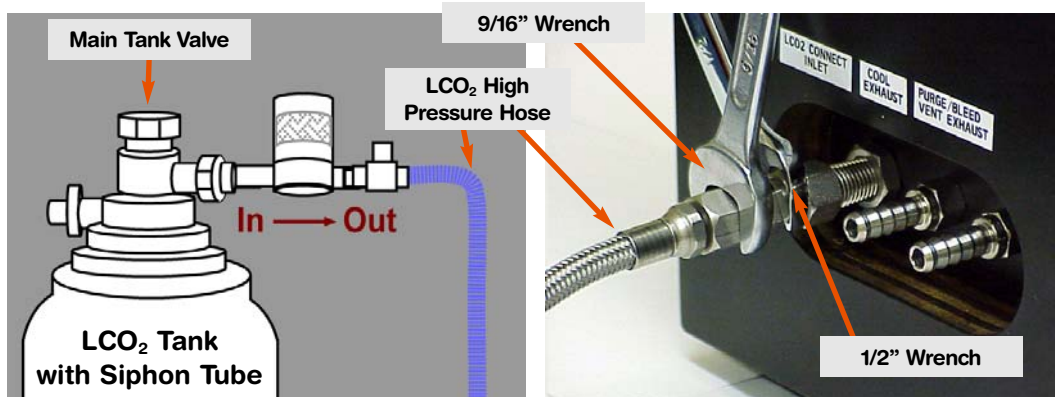
2. Disconnect 'PURGE / VENT' Exhaust Hose from the Autosamdri®-815.



3. Disconnect 'COOL / BLEED' Exhaust Hose from the Autosamdri®-815.



4. Close main LCO<sub>2</sub> tank valve, bleed LCO<sub>2</sub> High Pressure Hose. Disconnect LCO<sub>2</sub> High Pressure Hose using supplied 9/16" Wrench and 1/2" Wrench from the Autosamdri®-815 Connect Inlet.



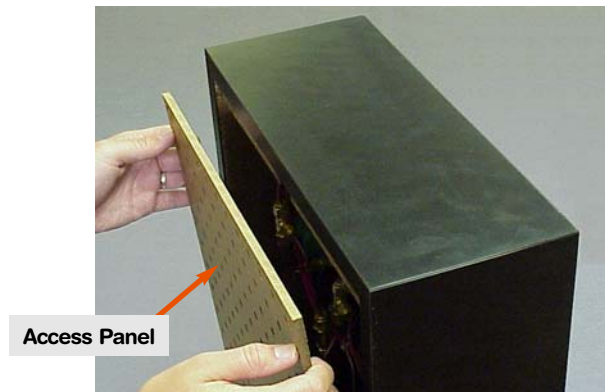
5. Carefully pick up the front end of and gently rest on its back end.



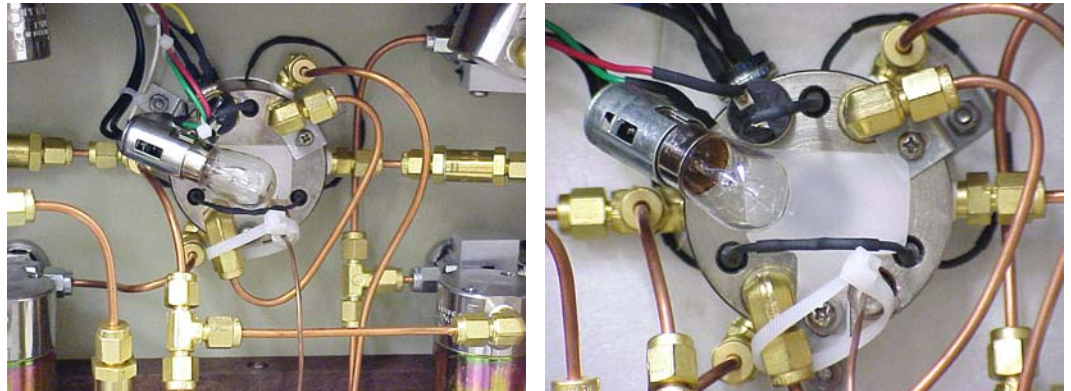
6. Unscrew the 4 black rubber legs that secure the access panel in place.



7. Remove and set aside the access panel. Note access panel orientation so that you may re-install panel in the same direction upon procedure completion.



8. Locate the Chamber Lamp as indicated below.



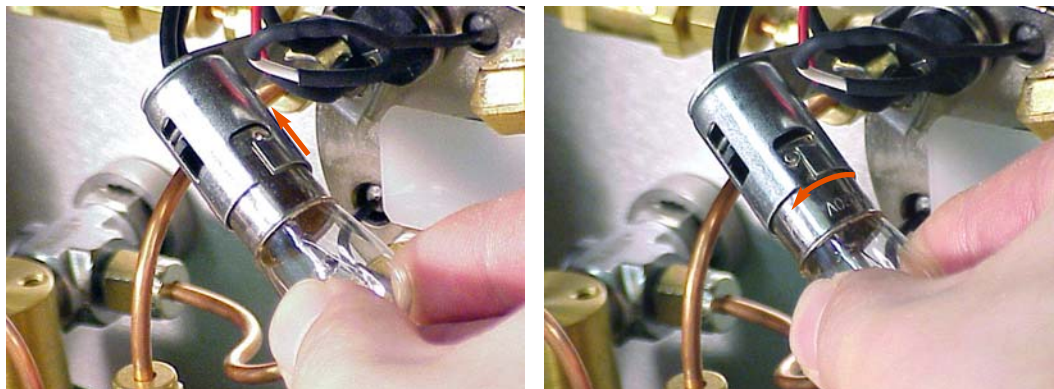
Autosamdri®-815, Series A Chamber View



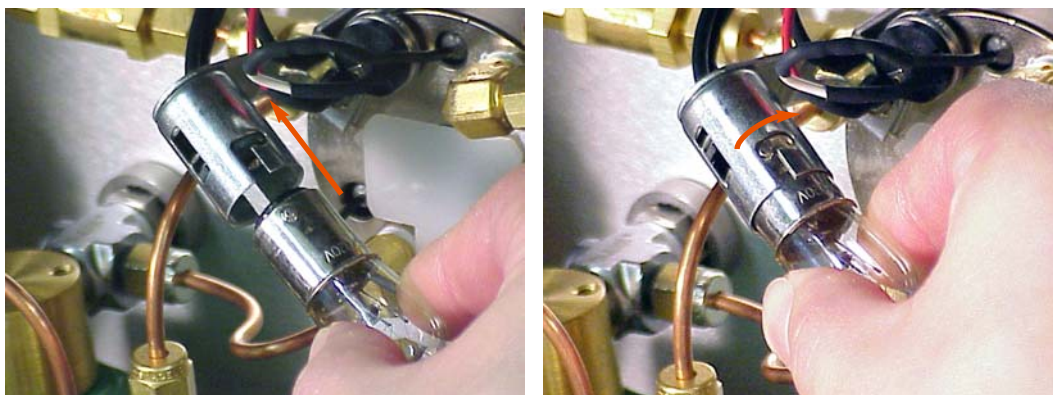
Chamber Lamp (Cat# 8770-10)



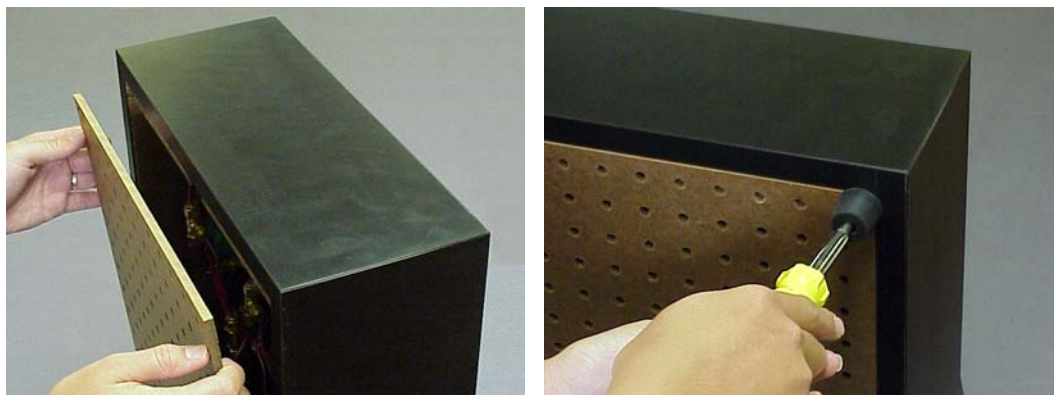
9. The Chamber Lamp is mounted into a "Bayonet" style lamp holder. Push Chamber Lamp towards the lamp housing and twist to the left to uninstall lamp (As shown below).



10. Install a new Chamber Lamp (Cat# 8770-10). Please note that you may need to support the Chamber Lamp housing with your free hand for support.

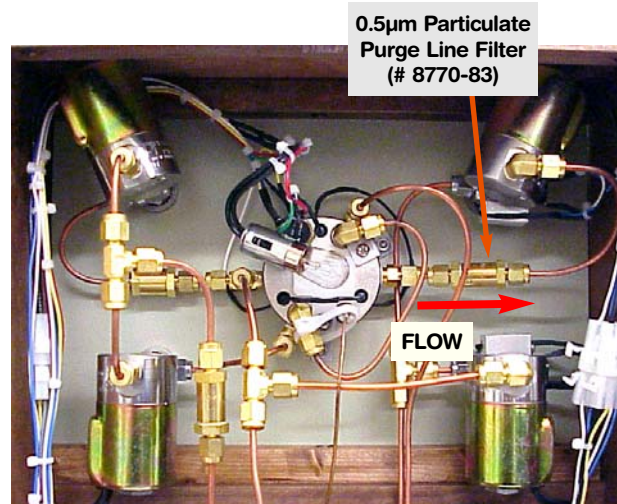


11. Re-install the access panel and re-connect power and all hose(s) prior to starting up system.

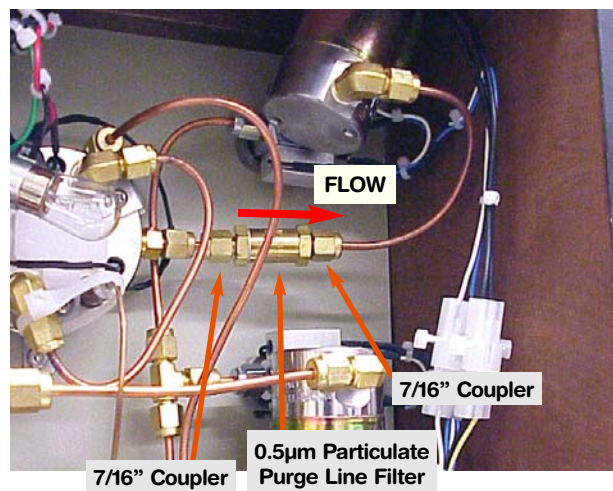


# Purge Line Filter Replacement Instruction

1. Repeat Step 1-7 of previous section (Chamber Lamp Replacement Installation) in order to remove access panel.
2. Locate the Purge Line Filter (# 8770-83) as indicated below. Note the Purge flow direction.



Autosamdri®-815, Series A Internal View





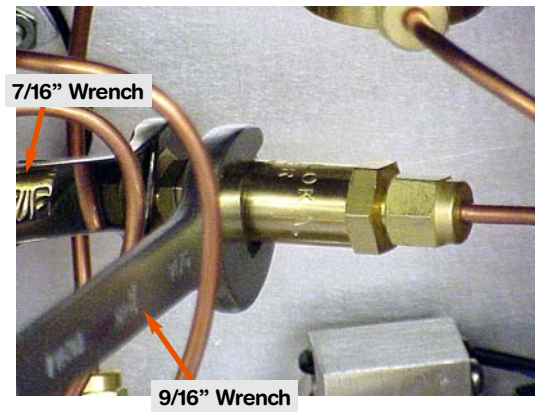
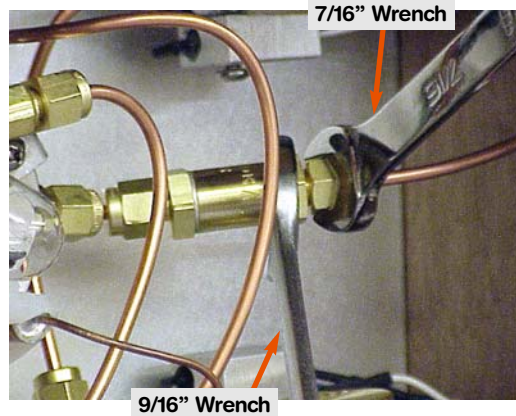
# Purge Line Filter Replacement Instruction

Flow Direction



Purge Line Filter, 0.5  $\mu\text{m}$  (#8770-83)

3. Disconnect Purge Line Filter by carefully holding Purge Line Filter steady with 9/16" Open-end wrench while disconnecting both 7/16" couplers. Carefully remove old Purge Line Filter and discard.



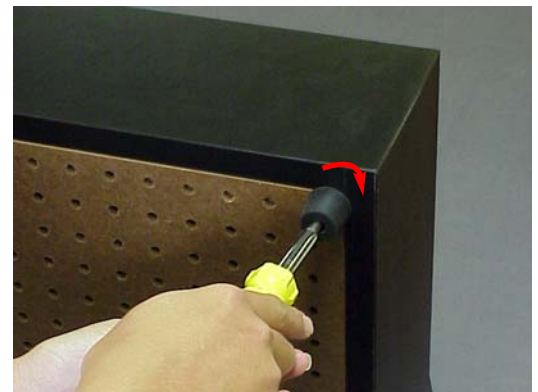
4. Install new Purge Line Filter paying attention to flow direction. Please note flow direction on the Purge Valve MUST be installed in-line with flow direction indicated in previous Autosamdri<sup>®</sup>-815, Series A Chamber Plumbing picture.

5. Re-install access panel. Re-connect power and all connection hose(s) prior to starting up system.



## NOTE:

It is recommended that the "Purge Line Filter" be replaced every 6 months with regular use. Change more frequently with heavy use. Please contact [techsupport@tousimis.com](mailto:techsupport@tousimis.com) with any questions.



# Appendix C



## Installing Autosamdri<sup>®</sup>-815 with SOTER<sup>™</sup> Condenser

**This section is for Installing Autosamdri<sup>®</sup>-815 with optional SOTER<sup>™</sup> Condenser (# 8777). See Chapter 2 (p.4) for installing without SOTER<sup>™</sup> Condenser.**



\* BOC gas suppliers refer to 99.8% purity grade as "2.8" grade. Air Products gas suppliers refer to 99.8% purity grade as "CP" grade. Always order LCO<sub>2</sub> tanks with Syphon (aka: dip) tubes. Minimum LCO<sub>2</sub> purity required is 99.8%.



\*\* LCO<sub>2</sub> tanks used in most facilities have tare weights ranging from 90 - 120lbs (40 - 55kg) and are delivered as "full" with net 50lbs (23kg) of compressed LCO<sub>2</sub>. GENERALLY, 50% IS USEABLE. You are advised to monitor the tank weight.

### PREPARATION OF INSTALLATION SITE

Upon receipt of your Autosamdri<sup>®</sup>-815, Series A, unpack the instrument carefully and check for any damage that may have occurred during shipment. Report (by Email [trc@tousimis.com](mailto:trc@tousimis.com) or Fax #301-881-5374) any irregularities immediately to tousimis<sup>®</sup>

Insist on clean surfaces. Minimum table top space of approximately 36"(92cm) Width x 30"(76cm) Depth should be allotted for the Autosamdri<sup>®</sup>-815, Series A and optional SOTER<sup>™</sup> Condenser with an additional 12"(31cm) x 12"(31cm) of floor space for the LCO<sub>2</sub> tank scale (See p.3).

Use bone-dry LCO<sub>2</sub> with a syphon (dip-tube) tank\* only. Do not use pressurized LCO<sub>2</sub> with Helium or any other high pressure substitute gas. Secure LCO<sub>2</sub> tank according to your facility's safety protocol.

Tank pressure typically reads 800psi (±5%) at room temperature. The amount of LCO<sub>2</sub> in tank is best monitored with a LCO<sub>2</sub> tank scale (See accessories p.28).

#### Typical nominal LCO<sub>2</sub> tank weights for Net 50lb LCO<sub>2</sub> tanks:

- Full tank: 140 to 170 lbs / Tare of tank: 90 to 120 lbs.
- Most of the time, you may use 50% of a 50lb. net weight CO<sub>2</sub> tank.
- It is good practice to have spare LCO<sub>2</sub> tanks stored in reserve in case a tank runs out during mid process.

A properly grounded 120V/50-60Hz outlet should be located within 4ft (1.2m) of set-up site.

### INSTALLATION OF THE Autosamdri<sup>®</sup> -815, Series A

This Autosamdri<sup>®</sup>-815, Series A is supplied with the basic accessories for operation with LCO<sub>2</sub> as a transitional fluid (for optional accessories, see p. 28).

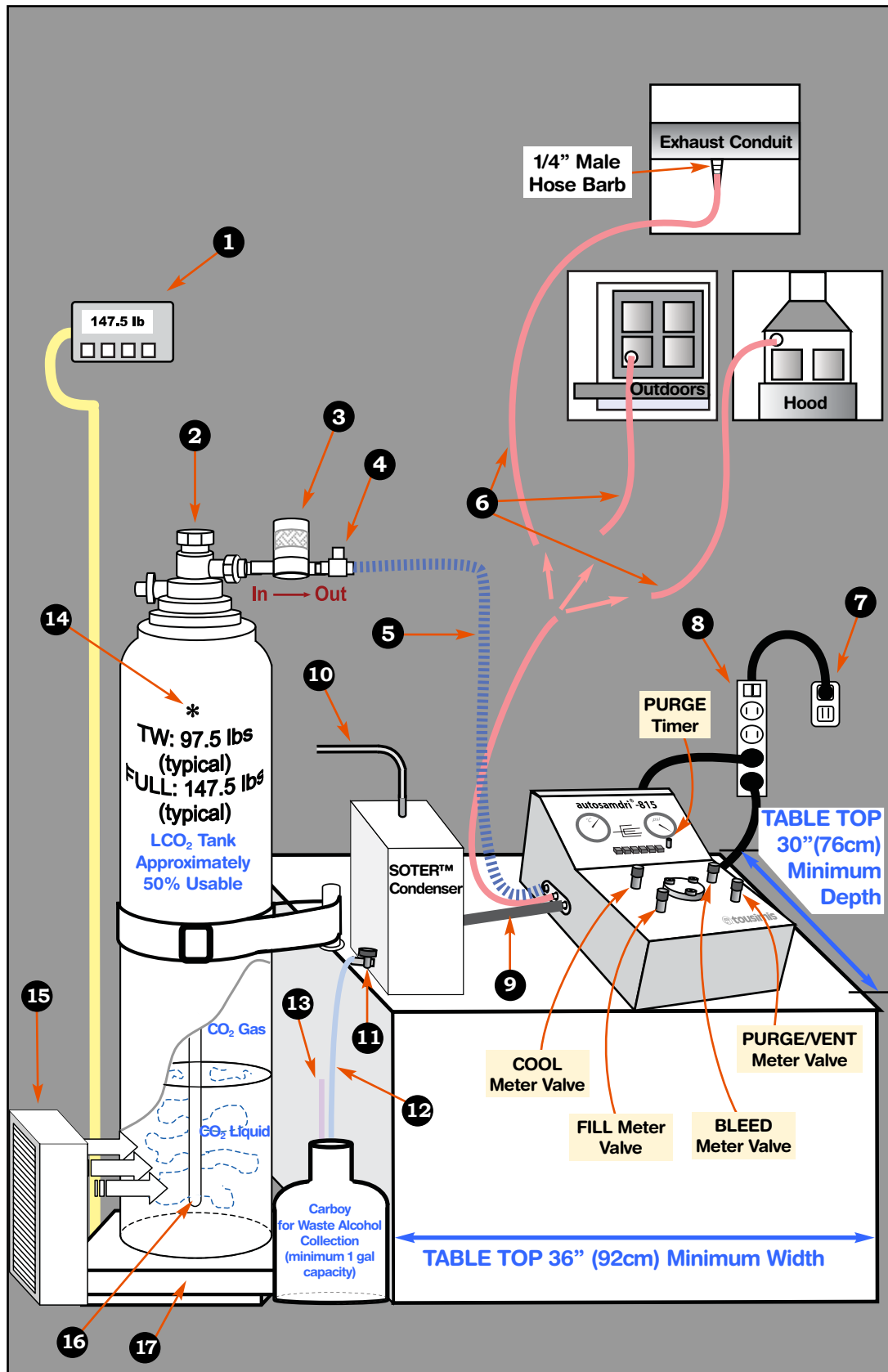
1. Position a LCO<sub>2</sub> tank with dip tube within 5feet (1.5m) of the 815. For a longer high pressure hose length, see p. 28, trc #8770-HPS. The LCO<sub>2</sub> tank should be mounted on a 400lb (182kg) capacity floor scale w/ remote LCD<sub>2</sub> display (trc #8770-54) to easily monitor LCO<sub>2</sub> supply\*\*.

2. No pressure gauges or regulators need be installed between the supply LCO<sub>2</sub> tank and the Autosamdri<sup>®</sup>-815, Series A LCO<sub>2</sub> connect inlet. The stainless steel-sheathed high pressure hose accompanying the unit is fitted with a CGA-320 hex coupling which accepts a 3/4" plastic gasket (supplied) and joins the hose directly to the CGA-320 threaded male nipple at the tank top (See p.22). ALL tanks are equipped with a rupture disc. All LCO<sub>2</sub> fittings and gasket surfaces should be kept clean and dry.

**NEVER OVER-TIGHTEN FITTINGS...TUBING ATTACHED MAY BE DAMAGED.**

## Autosamdri®-815, Series A Setup Overview

- ❶ Remote LCD readout of LCO<sub>2</sub> Tank Weight
- ❷ LCO<sub>2</sub> Cylinder ON/OFF Valve
- ❸ External tousimis® Combination Filter (#8784)
- ❹ T-Filter w/ 0.5µm Element
- ❺ High Pressure Hose (5ft long, other lengths available upon request)
- ❻ COOL/BLEED CO<sub>2</sub> Exhaust Tube to Hood, Exhaust Conduit or Outdoors. White (1/4" ID), 10ft
- ❼ 120V Properly Grounded Outlet (from either Wall or Transformer)
- ❽ Power Strip for 815 and SOTER™ Condenser
- ❾ Exhaust Connect to SOTER™ Condenser
- ❿ Condenser Vent Outlet (1/4" ID) to Hood, Exhaust Conduit or Outdoors., 10ft
- ⓫ Condenser Drain Valve. Always maintain "OPEN" position during process run, except when relocating SOTER™ Condenser or emptying Carboy
- ⓬ Condenser Clear Drain Tubing (1/4" ID), 6ft, routed to Carboy
- ⓭ Carboy Exhaust Tube to Hood or Outdoors, 15ft.
- ⓮ Tare Weight Varies (Consult your LCO<sub>2</sub> supplier or may be stamped on tank)
- ⓯ Ceramic Heater or Heater Jacket may be required in a cold tank placement position
- ⓰ Syphon(Dip) Tube
- ⓱ LCO<sub>2</sub> Tank Scale with Remote LCD Display (trc# 8770-54)

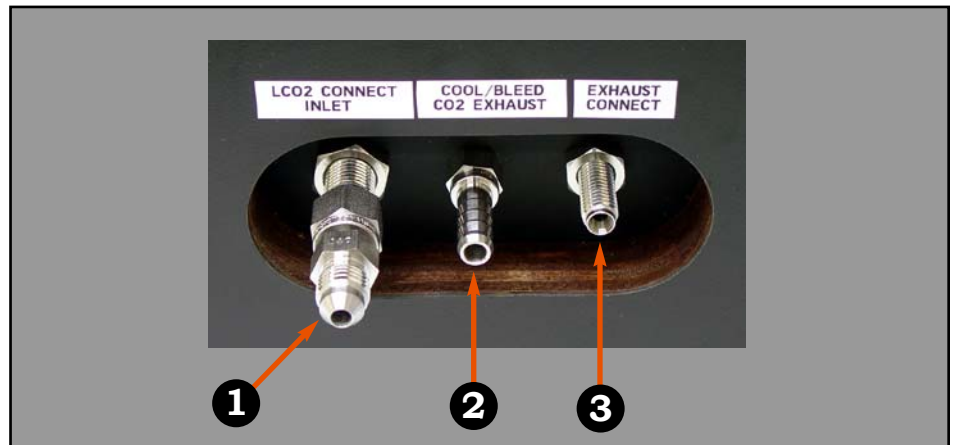


\* At Room Temperature (20°C - 24°C), average LCO<sub>2</sub> tank pressure is 800psi (+/- 5%).

3. The tousimis® LCO<sub>2</sub> Filter Assembly (tousimis® catalog #8784) is factory installed directly onto the high pressure hose (See p.22-23). This helps prevent sample contamination from oil, water and particulates. Change the #8784A filter element with every 500lbs (226.8kg) LCO<sub>2</sub> tanks changes. The secondary 0.5µm T-Filter element may be removed, ultra-sonicated and reinstalled every 1 year.

## Autosamdri®-815 Inlet / Outlet Connect

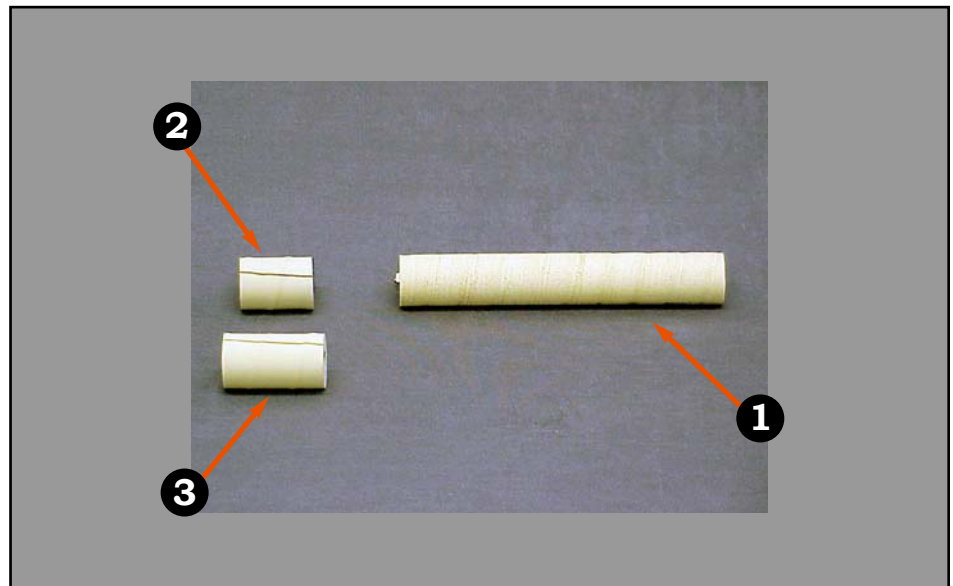
- 1 LCO<sub>2</sub> Connect Inlet
- 2 COOL/BLEED Exhaust Outlet
- 3 Exhaust Connect to SOTER™ Condenser (PURGE/VENT)



## Exhaust Connect Line, Exhaust and Condenser Vent Insulates

4. Connect the SOTER™ Condenser to Autosamdri®-815 through 'Exhaust Connect', see picture sequence below.

- 1 Exhaust Connect Line (7.0" Length)
- 2 Exhaust Insulate (1.75" Length)
- 3 Vent Insulate (2.25" Length)





## Connecting SOTER™ Condenser to Autosamdri®-815



**\* NOTE:**  
Never over-tighten 7/16" fittings that connect "Exhaust Connect Line" to both SOTER™ Condenser and Autosamdri®-815. Damage may result!

**STEP 1** Autosamdri®-815  
7/16" Open End wrench  
Exhaust Connect Line

**STEP 2** Autosamdri®-815

Use supplied 7/16" Open End Wrench to attach Exhaust Connect Line to both Autosamdri®-815 and Condenser.\*

**STEP 3** Autosamdri®-815

After 7/16" coupler is connected to Autosamdri®-815, gently slide white outer insulation towards 815

**STEP 4** SOTER™ Condenser

**STEP 5** Exhaust Insulate  
SOTER™ Condenser  
Autosamdri®-815

**STEP 6** SOTER™ Condenser  
8" Wire Tie

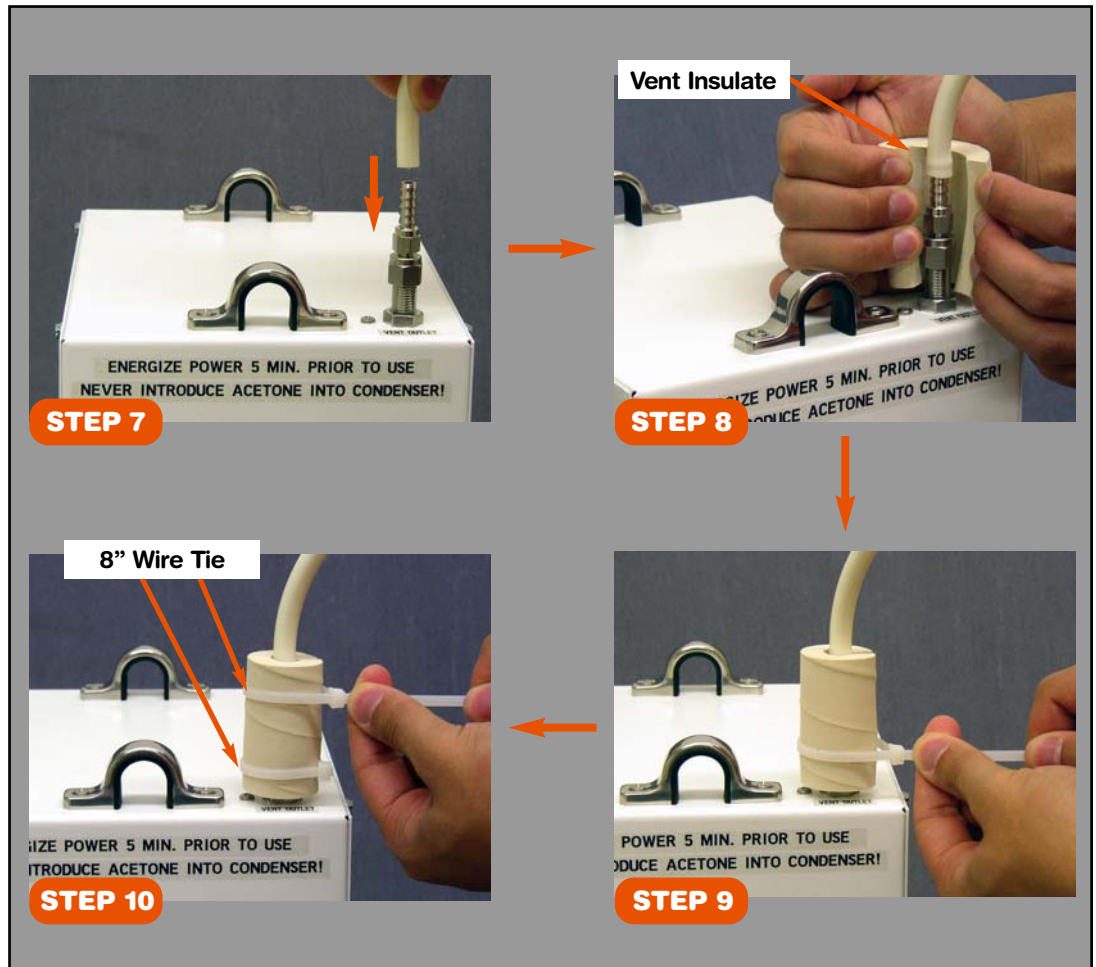
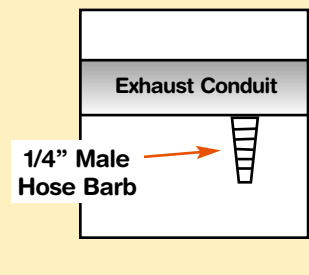
5. Connect the white 10' length of 'Condenser Exhaust Tubing' to the Condenser 'Vent Outlet' and cover the 'Vent Outlet' with the provided 'Vent Insulate' (See Step 8-9 on next page).

## Connecting Condenser Exhaust



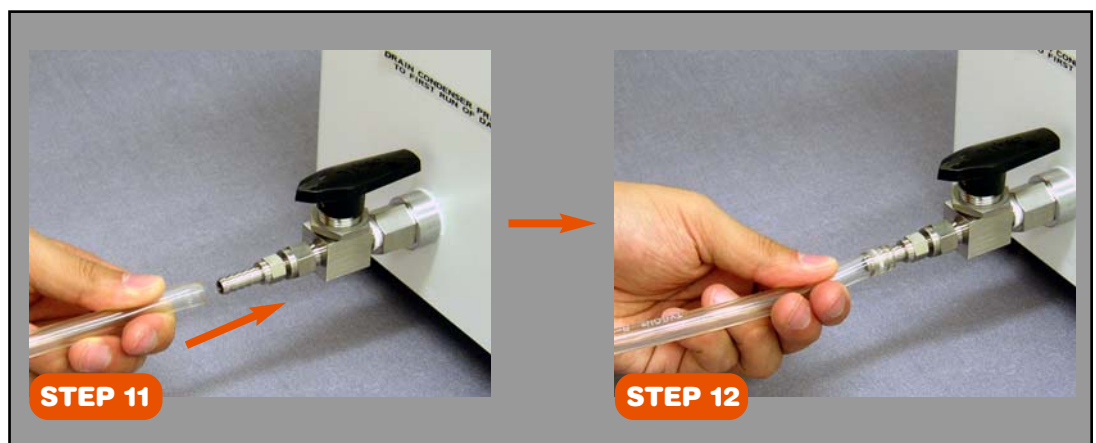
**NOTE:**

It is best to route Condenser Exhaust Tubing to facility Exhaust Conduit and attach via 1/4" male hose barb to conduit.



## Connecting Condenser Drain

6. The 6' length of Clear Tygon 'Condenser Drain Tubing' should be placed onto the condenser's drain hose barb. The clear hose will allow you to visually see the alcohol draining into your carboy or Facility's Solvent Drain.





## SOTER™ Condenser Exhaust Connect Overview

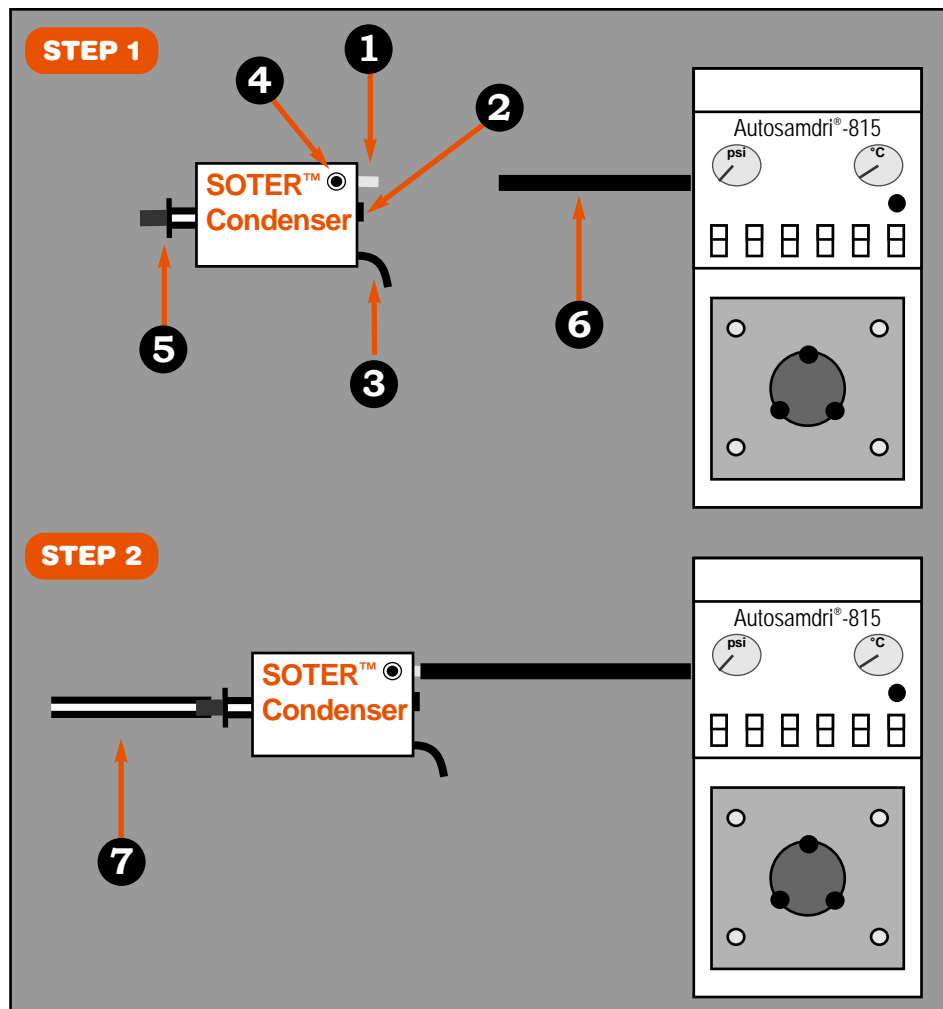
- 1 Exhaust Connect
- 2 Power ON / OFF
- 3 120V Power Cord
- 4 Vent Outlet (Attach 10' White Exhaust Tubing to Exhaust Conduit)
- 5 Alcohol Drain Valve (Leave in "Open" Position, except when relocating SOTER™ Condenser).
- 6 Exhaust Connect, 8"
- 7 Attach 6' clear Condenser drain tubing and lead to a Carboy (1 gal minimum) or Solvent Drain



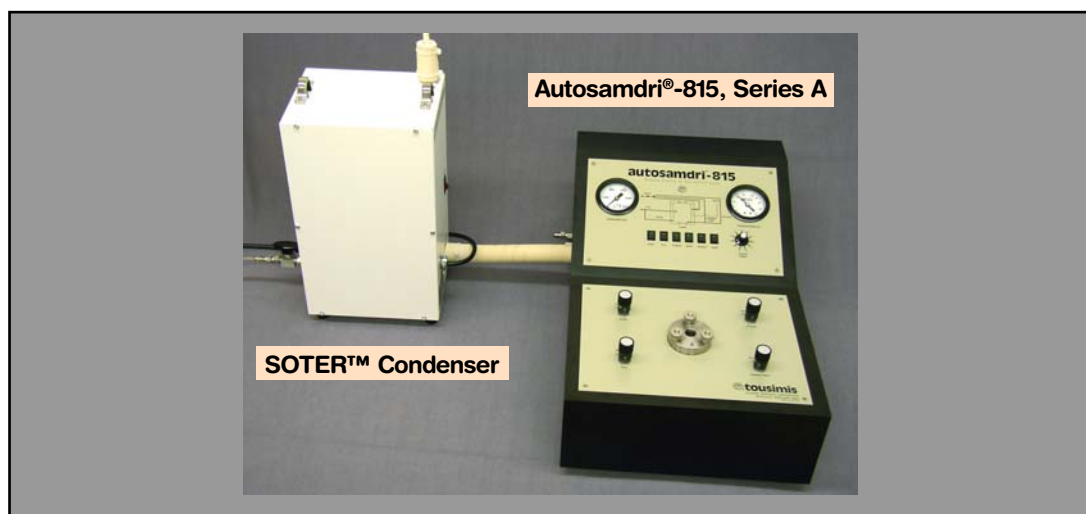
### NOTE:

Do not over-tighten fittings on either end of Exhaust Connect. Check for leaks during the first run after connecting. Tighten as necessary with 7/16" wrench.

**DO NOT OVER-TIGHTEN**



## Autosamdri®-815 with SOTER™ Condenser Overview

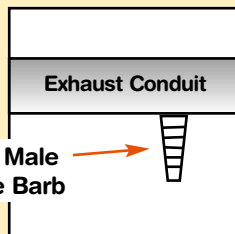


## Connecting COOL/BLEED CO<sub>2</sub> Exhaust



### NOTE:

It is best to route COOL / BLEED CO<sub>2</sub> EXHAUST to facility Exhaust Conduit via 1/4" male hose barb (if possible).

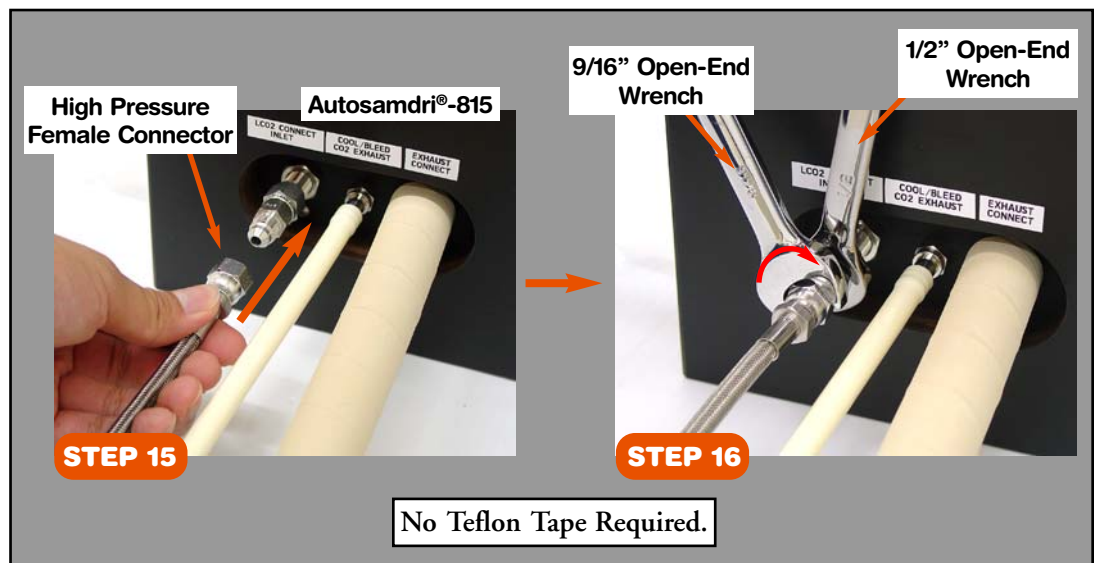


7. Attach the 10ft White exhaust tubing provided to the COOL/BLEED CO<sub>2</sub> Exhaust outlet on the left-hand side of the Autosamdri®-815, Series A. Tubing should be free of kinks which could block passage of rapidly exiting noisy gas or solid flakes of CO<sub>2</sub>.

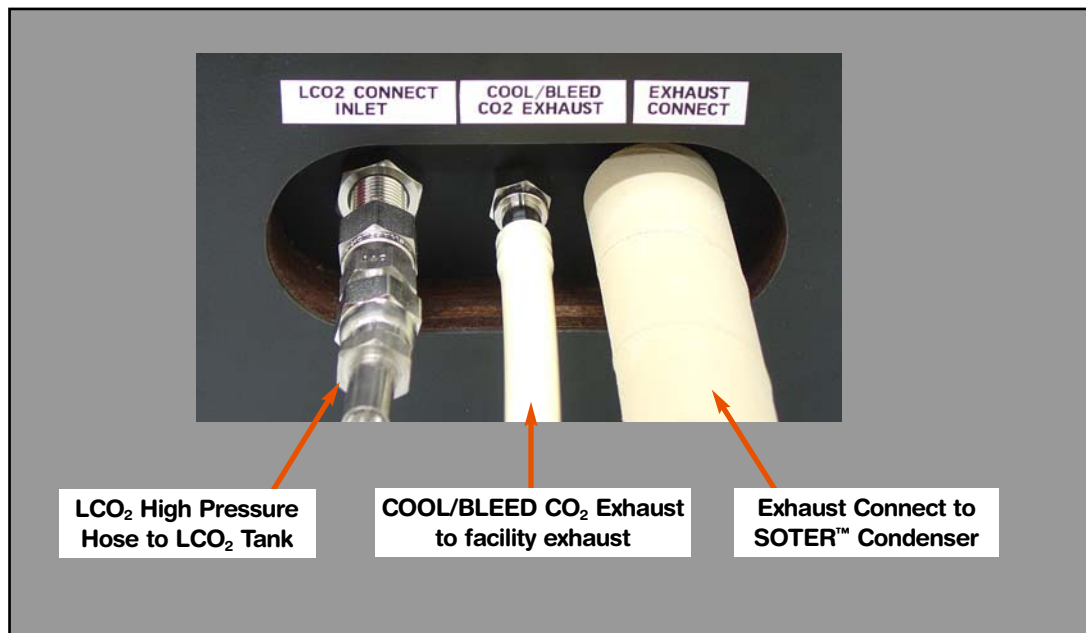


## Connecting LCO<sub>2</sub> Supply

8. Attach the HIGH PRESSURE HOSE to the Autosamdri®-815 LCO<sub>2</sub> Connect Inlet. Gently tighten the High Pressure Female Connector using the two open end wrenches provided (the 9/16" onto the Hose and the 1/2" onto the Inlet). Stop at the feel of first resistance; re-tighten if necessary, should it leak.

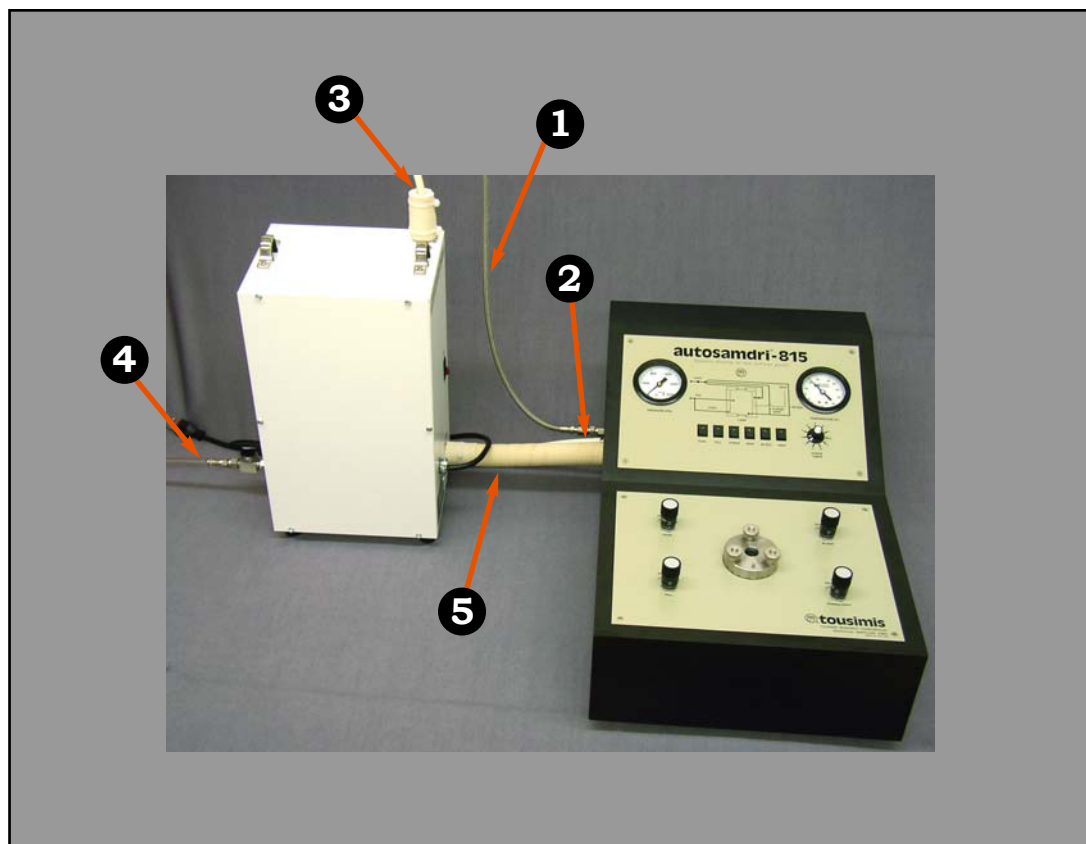


## Autosamdri<sup>®</sup>-815 Inlet / Outlet Connect View



## Autosamdri<sup>®</sup>-815 with Complete Connects

- 1 LCO<sub>2</sub> High Pressure Hose
- 2 COOL/BLEED CO<sub>2</sub> Exhaust Tubing
- 3 SOTER<sup>™</sup> Condenser Vent Outlet
- 4 Condenser Drain Tubing to a Carboy or Facility's Solvent Drain
- 5 Exhaust Connect



9. Connect Condenser Drain Tubing (clear) to a Carboy (1 gal minimum) or Facility's Solvent Drain. Condenser Drain Valve should always be maintained in the "OPEN" position during the process run, except when relocating Condenser or emptying Carboy. Connect Carboy Exhaust Tubing (white) to Fume Hood or Outdoors (See p.39 "Setup Overview").

## Connecting Power Supply

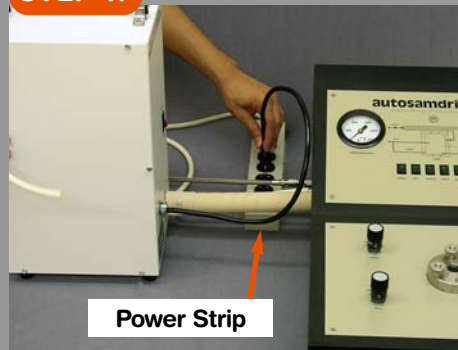
10. Make certain facility 120V Power Supply is properly grounded and plug-in the Power Strip supplied. Next, plug in both the SOTER™ Condenser and Autosamdri®-815 Power Cords into the Power Strip.



### NOTE:

Please be certain that both Autosamdri®-815 and the SOTER™ Condenser power switches are in the 'OFF' position before plugging their power cords into the Power Strip.

### STEP 17



Power Strip

Connect SOTER™ Condenser Power Cord

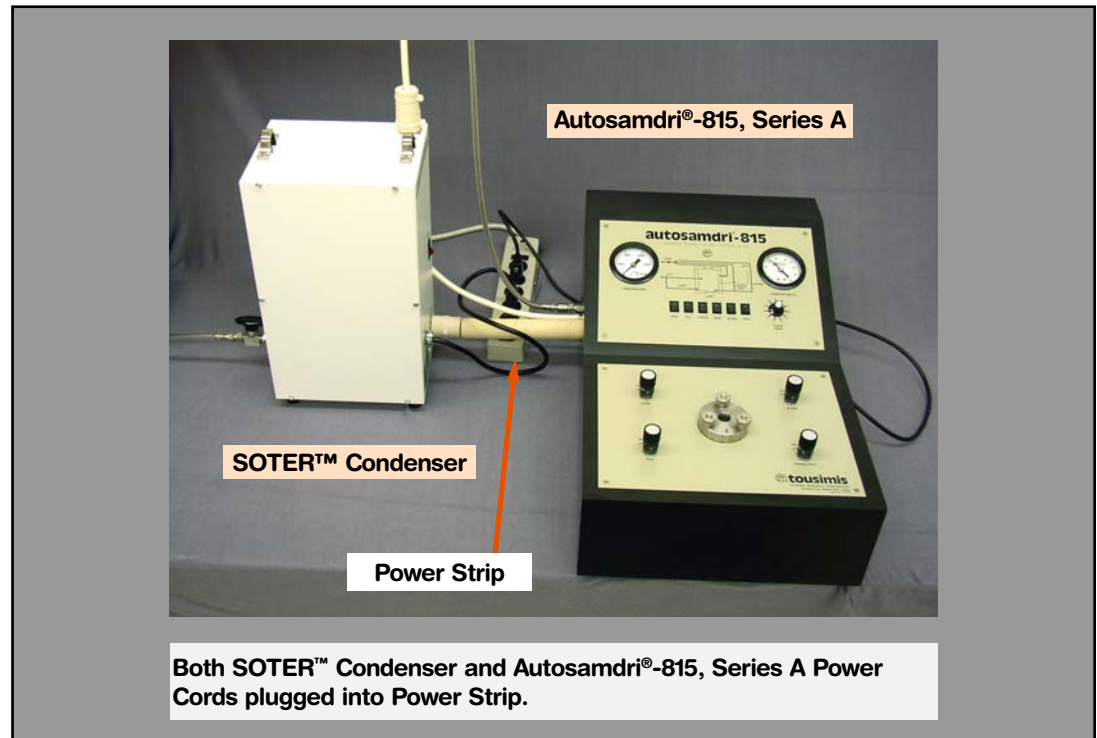
### STEP 18



Power Strip

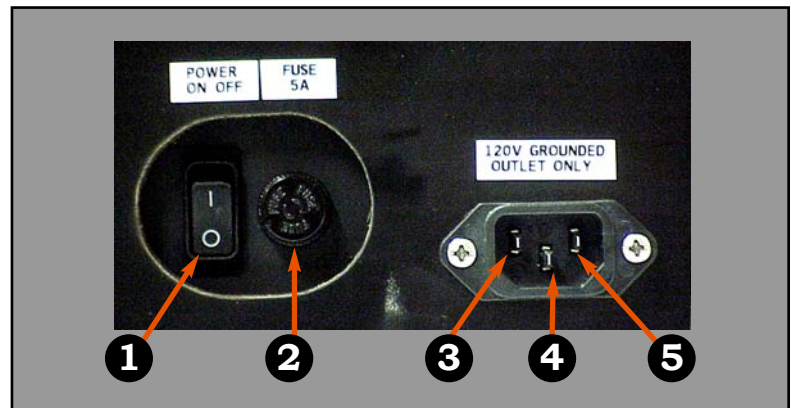
Connect 815 Power Cord

## Autosamdri®-815, Series A Set-Up Overview



## Autosamdri®-815, Series A Power Panel

- 1 POWER ON / OFF SWITCH
- 2 FUSE 5 AMP (Bayonet Style Access)
- 3 AC (BLACK) HOT
- 4 GROUND 120AC/50-60HZ
- 5 AC (WHITE) NEUTRAL

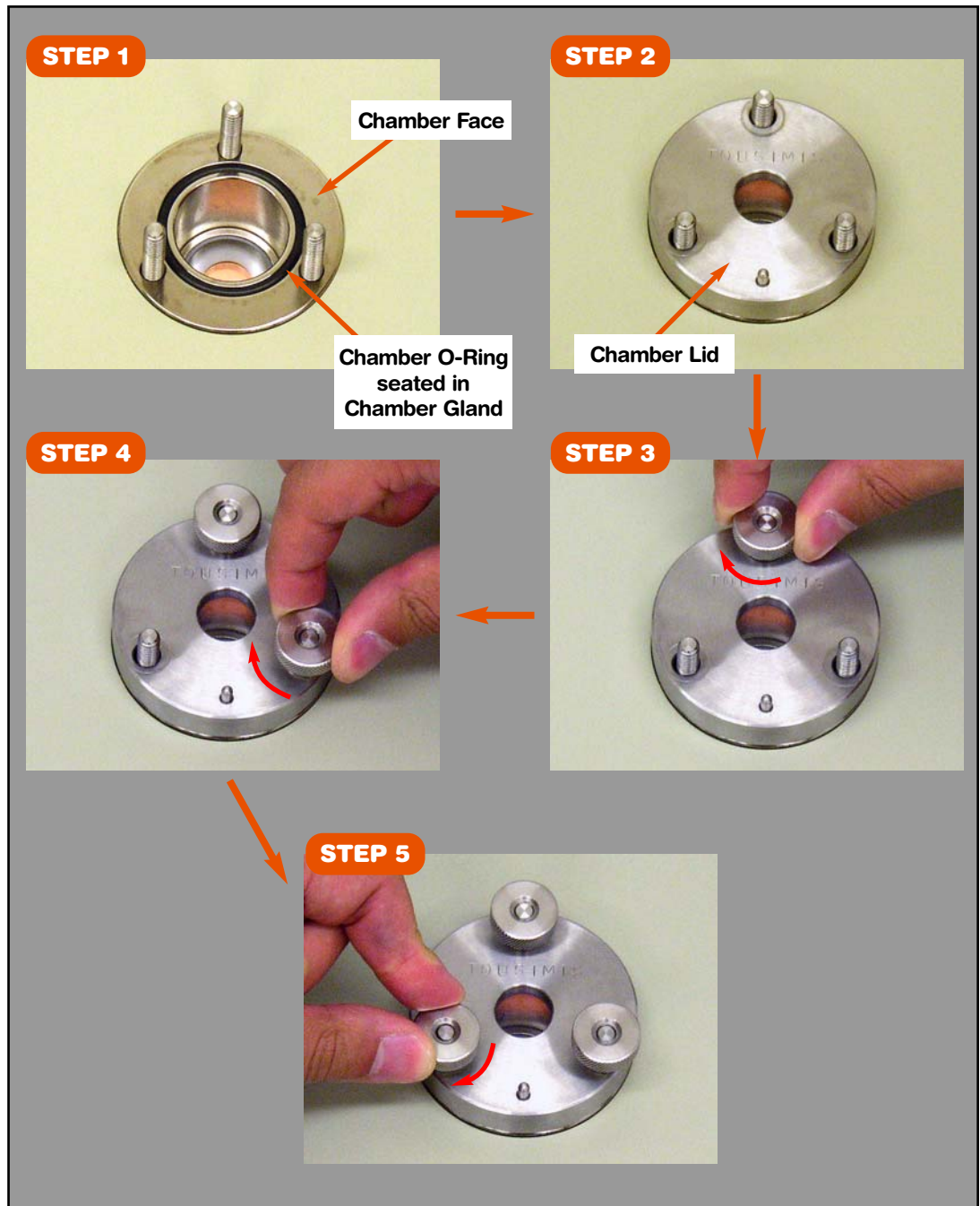




## Closing Autosamdri®-815 Process Chamber

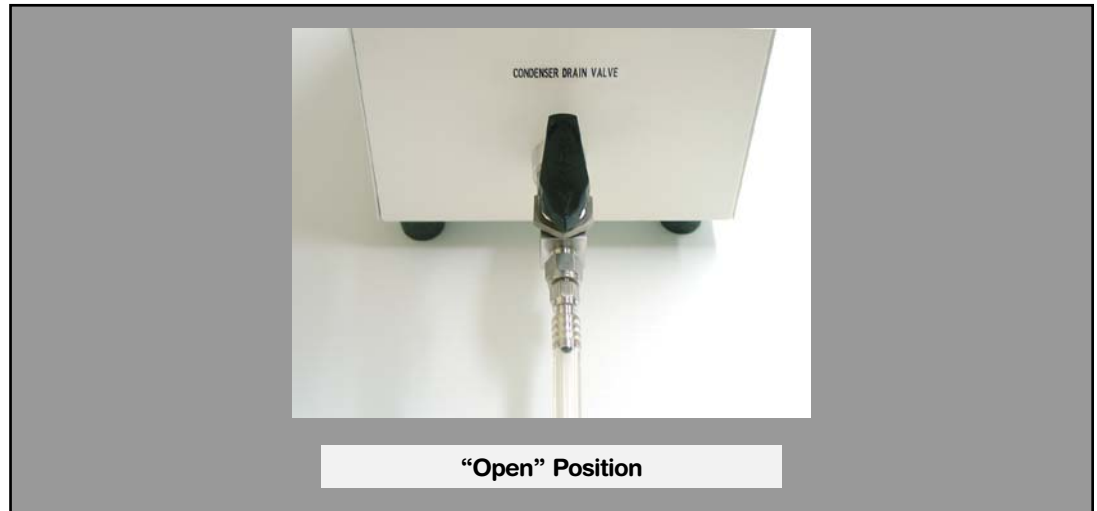
### Chamber Sealing Procedure

1. Prior to placing chamber lid onto chamber, be sure that o-ring and surrounding chamber surface is clean and moisture free (NO Grease).
2. Carefully align chamber lid over chamber and carefully lower onto chamber face.
3. Carefully place the 3 knurl nuts onto each appropriate chamber post and turn in a clockwise direction until flush with chamber.



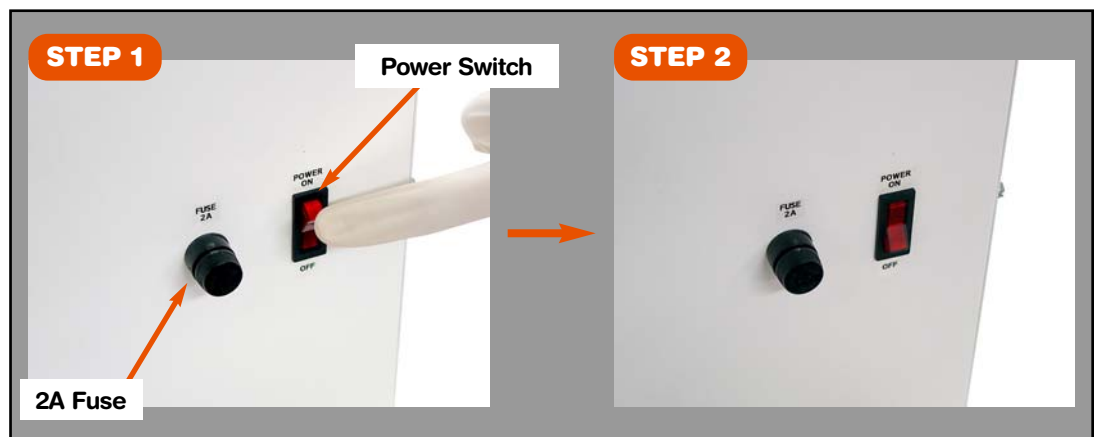
## SOTER<sup>™</sup> Condenser Drain Valve

Condenser Drain Valve. Always maintain “OPEN” position during process run, except when relocating SOTER<sup>™</sup> Condenser or emptying Carboy.



## SOTER<sup>™</sup> Condenser Power Switch

Turn SOTER<sup>™</sup> Condenser Power Switch “ON” 3-5 minutes prior to process run.



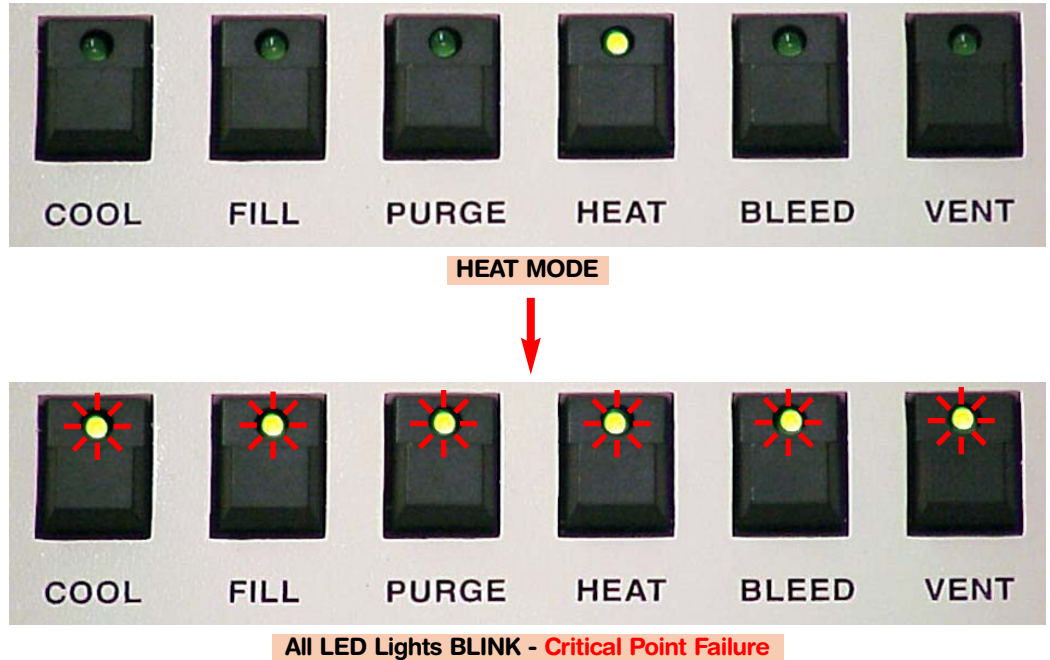
# Appendix D

## Critical Point Failure Correction



### All Green LED Lights Blink

**Symptom:** During HEAT mode, all Green LED's of the Autosamdri® (Automegasamdri®) begin to blink.

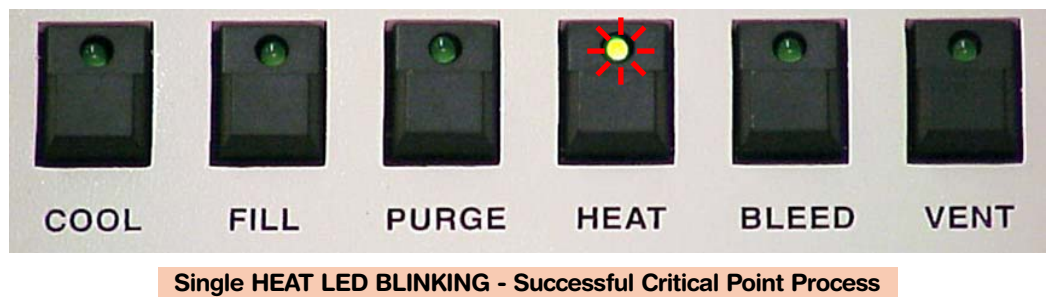


#### NOTE:

The typical Critical Point Failure is due to the pressure not reaching the pressure sensor pre-set 1200 psi in the process chamber. The overwhelming reason for Critical Point Failure is due to insufficient LCO<sub>2</sub> remaining in the LCO<sub>2</sub> tank.

**Description:** The All LED Blinking Symptom indicates that the Temperature and/or Pressure in the process chamber has not reached the Critical Point in the proper sequence during HEAT mode.

**Background:** The system indicates a successful Critical Point run when the lone HEAT LED blinks ON/OFF by itself as indicated in the picture below:



A successful Critical Point process run is achieved when the internal micro processor receives the following two signals in this sequence:

1. Pressure Signal sent via High Pressure Sensor @ 1200 psi.
2. Heat Signal sent via Heat Thermostat shutting "OFF" typically between 34-38°C

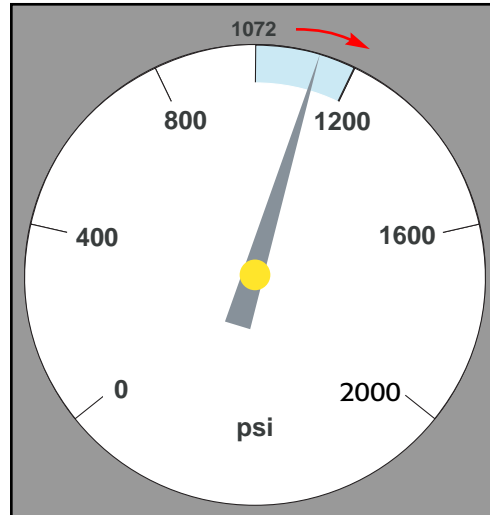
## Critical Point Failure Correction Options:

Provided the micro processor receives the signals in the above sequence, there will not be a 'Critical Point Failure'.

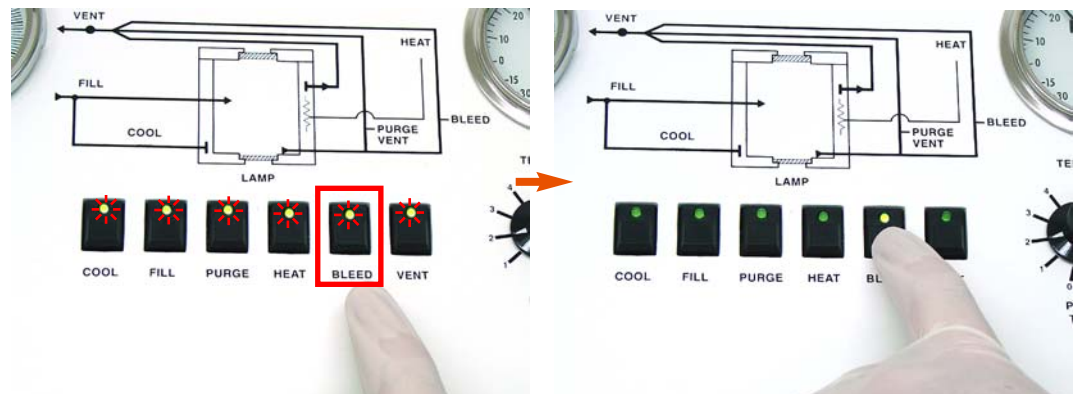
However; should the micro processor receive these signals in the reverse order ... Heat Signal (1st) followed by Pressure Signal (2nd) ... a failure will be indicated via all the LED's blinking.

## Solutions:

**Scenario #1: Pressure is greater than 1072 psi.**



Press BLEED button.

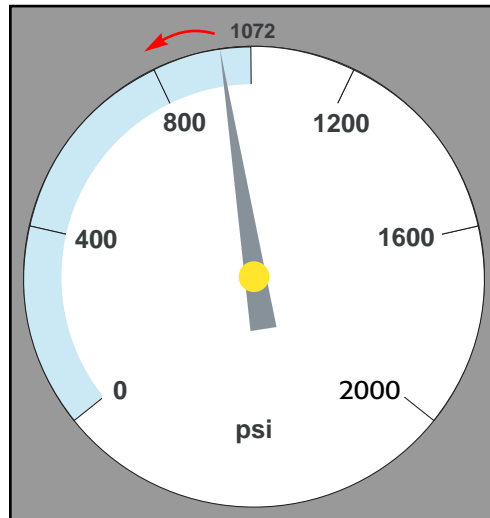


All blinking LED's will turn OFF, system will default back to to the normal Auto-Operation mode and resume in BLEED mode moving on to decompression and process completion as per normal.

The LCO2 tank should be replaced with a new LCO2 tank prior to commencing the next process run.

Scenario #1 may be deployed as the theoretical physical completion of the critical point (1072psi and 31°C) for CO2 has been attained even though the system's sensors did not detect it. The system's sensors are designed to 'over-shoot' both the pressure and temperature minimums for the CO2 Critical Point.

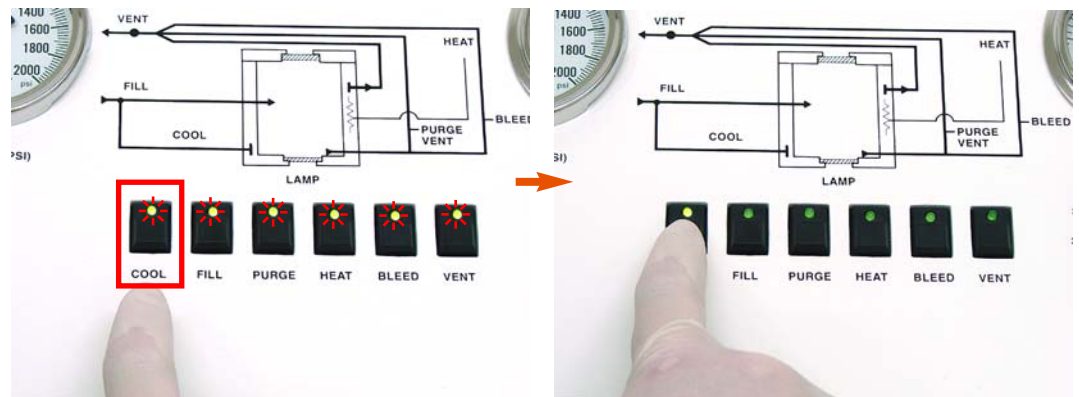
Scenario #2: Pressure is less than 1072 psi.



Replace LCO2 tank with a new LCO2 tank.

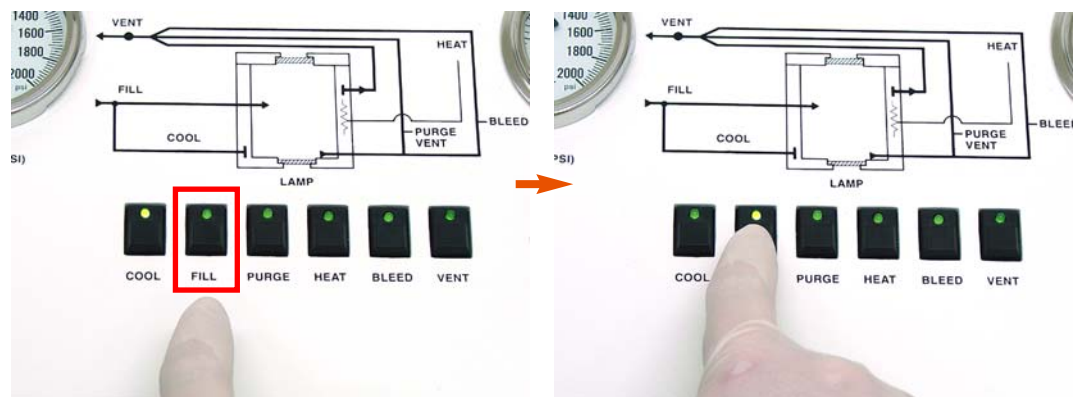
DO NOT OPEN CHAMBER AT THIS POINT.  
MAINTAIN SAMPLE PRODUCT WITHIN PROCESS CHAMBER.

Press COOL button to re-initiate the process.



All blinking LED's will turn OFF, system will default back to the normal Automatic Operation Mode.

Press FILL Button as per normal initiation of a new process run.





# 220V→110V Step-Down Transformer Schematic

## 220V → 110V Step-Down Transformer Schematic



1. Read Transformer Set-Up instructions included with transformer and set Input Voltage to 220V (Set Input Voltage to 220V in Israel).
2. Make sure transformer "Power" is OFF position.
3. Plug Transformer into 220V Outlet (Connect plug adapter if necessary).
4. Plug supplied Power Strip to Transformer 110V Output.
5. Connect 815 Power and LCO<sub>2</sub> Tank Scale Power.
6. Turn Transformer Power Switch ON
7. Turn 815 ON.
8. Activate LCO<sub>2</sub> Tank Scale.

