
# MK 3 Bi-Directional Operating Guide

# Safety Guidelines

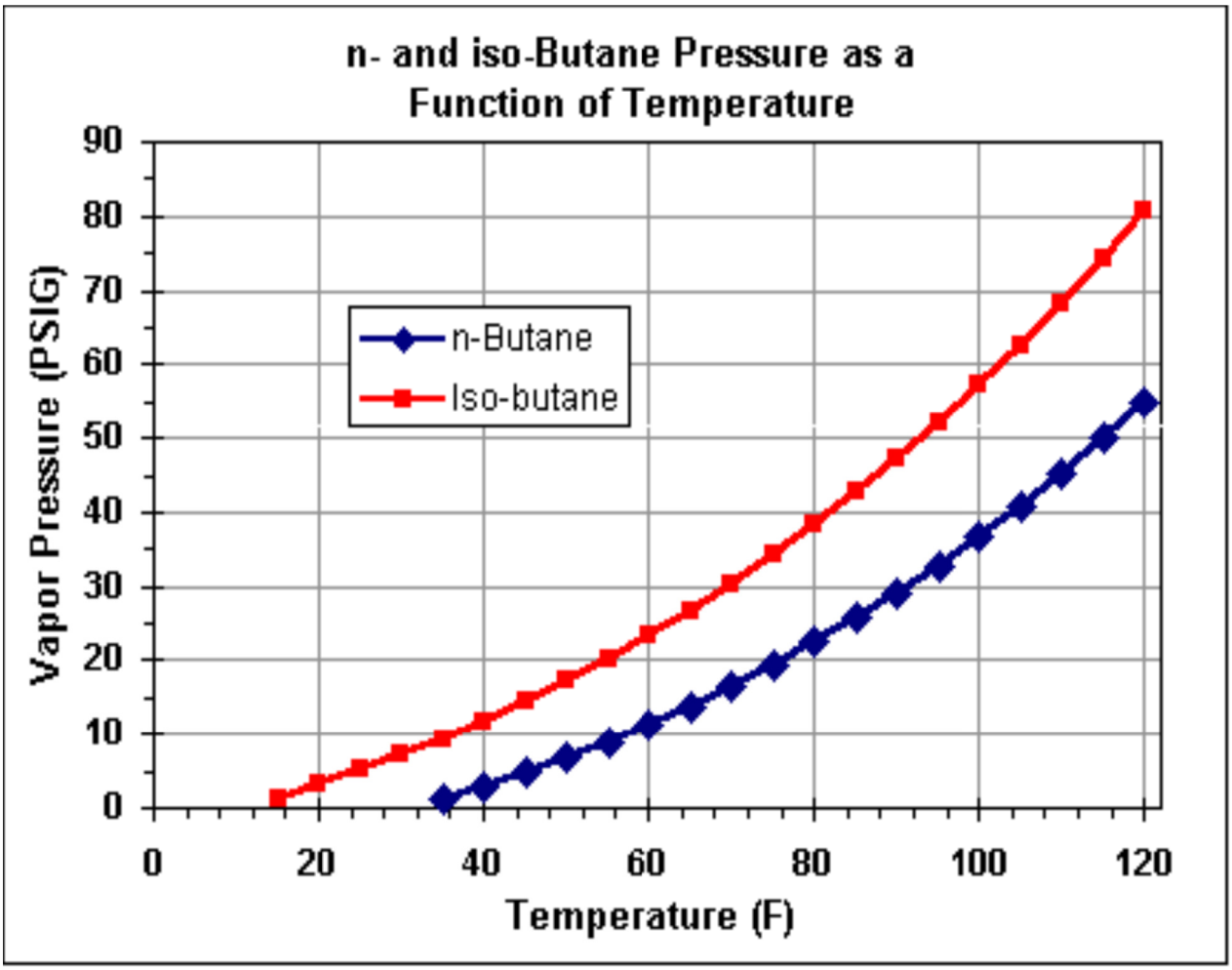
- Read this entire manual thoroughly before operating the equipment. Failure to follow instructions could result in serious injury or death.
- Always evacuate system of all oxygen prior to introducing flammable solvents.
- Improper treatment or use of the extractor can damage it, shorten its life, and void your warranty.
    - Use the extractor only for intended purposes.
    - DO NOT expose extractor to conditions not intended for it.
    - DO NOT allow outside interference during operation.
    - DO NOT operate if any equipment appears to have a malfunction.
    - DO NOT modify extractor. Contact manufacturer for repairs/modifications.
    - DO NOT over-pressurize equipment.
        - **Maximum** Operating Pressure: 120 psig
    - Always have an ABC fire extinguisher ready in the area.
- Butane (also called LPG-Liquefied Petroleum Gas or LP-Gas) is a liquid fuel stored under pressure. LP-Gas is highly flammable when mixed with air (oxygen) and can be ignited by many sources, including, but not limited to, open flames, smoking materials, electrical sparks, and static electricity. Severe "freeze burn" or frostbite can result if LP-Gas liquid comes in contact with your skin. Reference a Material Safety Data Sheet (MSDS) for more detailed information and personal protective equipment (PPE) that must be used when using this equipment.
- In the event that there may have been some amount of atmosphere recovered into the Butane Storage Tank, the air should be "burped" from the tank. This procedure should NOT be done on a regular basis. This procedure should ONLY be performed in a Class 1 Division 1 area. Air has a specific gravity of about 1.0 and butane has a specific gravity of about 2.0. What that means is butane is heavier than air, so the air would float up above the butane. With the tank in the upright position, the vapor valve can be opened very slightly to relieve pressure. The butane vapor will "push" the air out of the vapor valve. The valve should be closed as soon as the scent of butane is noticed (Petroleum odor) or fumes are viewed.

## *Accessories*

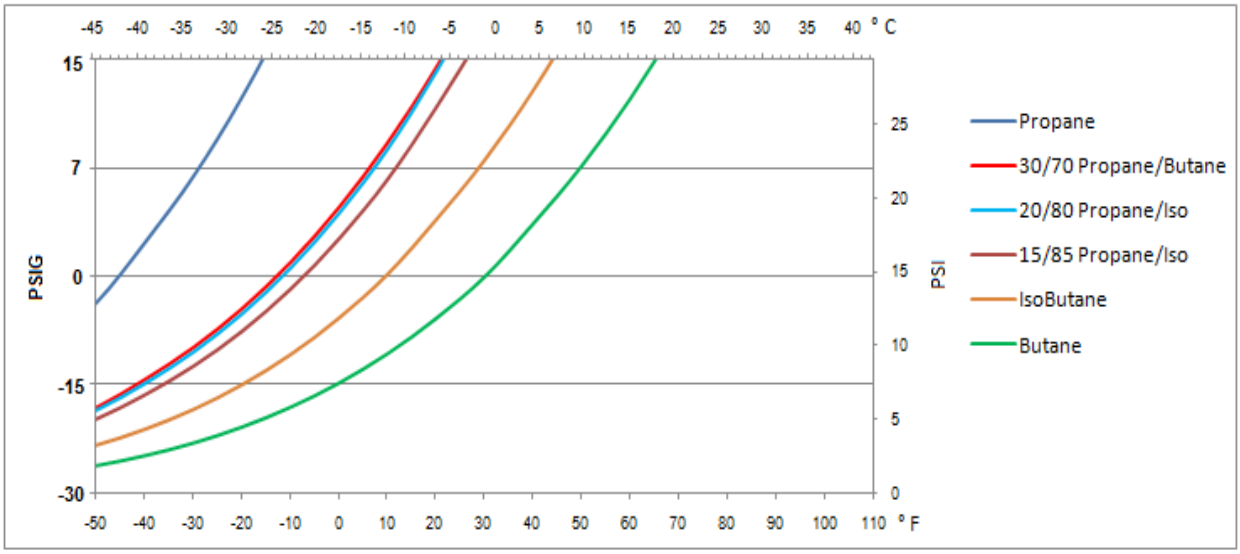
Terpp Extractors sells accessories designed to help or enhance the operation of closed loop extractors. To browse and learn more about these accessories visit our web site at

| Hazard | Cause | Safeguards |
|---|---|---|
| Asphyxiation | Release of LP-Gas in the facility due a relief valve cracking or a leaking seal or fitting | A local LP-Gas monitor shall be in operation at all times during the extraction process or where LP-Gas is used or stored.<br>Proper signage must be posted on the exterior door of each room/area utilizing LP-Gas and in each room storing LP-Gas. NFPA 704 Hazard Diamonds shall be posted at the exterior main entrance and at rooms where LP-Gas is used or stored. |
| Asphyxiation | Release of LP-Gas in the facility due to a leaking seal or fitting | An appropriate hazardous exhaust system is required. In addition, every occupied space shall be ventilated by natural means or by mechanical means in accordance with the International Mechanical Code (IMC). Ventilation shall be provided during the periods that the room or space is occupied. Natural ventilation of occupied space shall be through windows, doors, louvers, or other opening to the outdoors. The minimum open-able ventilation area to the outdoors shall be 4 percent of the floor area being ventilated. Mechanical ventilation shall be capable of delivering 15 cubic feet per minute (cfm) per person. |

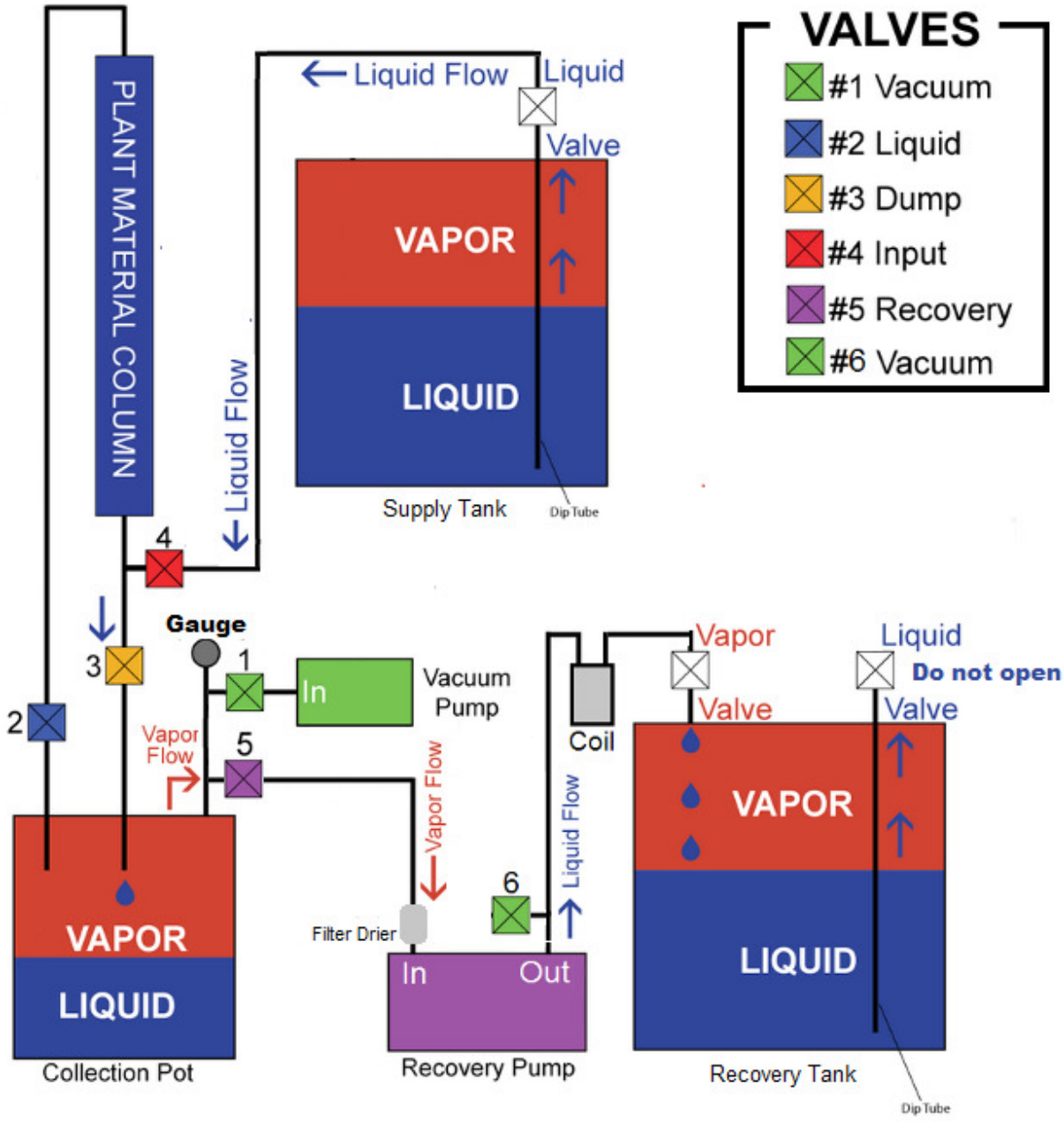
| Hazard | Cause | Safeguards |
|---|---|---|
| Contact with skin or eyes | Release of LP-Gas in the facility due to a leaking seal or fitting | Appropriate PPE should be worn at all times. Refer to the LP-Gas solvent's MSDS for detailed information. |
| Explosion or<br>Fire | Release of LP-Gas in the facility due to relief valves cracking or a leaking seal or fitting | The facility must have an appropriate hazardous exhaust system installed to ensure any LP-Gas release is exhausted from the space.<br>All potential electrical ignition sources must be located at least three meters (10 feet) from the extractor. Additionally, all potential electrical ignition sources must be elevated at least 18 inches off the floor. The facility must provide adequate ventilation/exhaust as determined by the Engineer of Record in order to maintain the local atmosphere below 25% of the Lower Flammability Limit (LFL) for this application. Ancillary equipment should be located in another room. An alarming hydrocarbon detector shall be employed in the extraction area. |


n- and iso-Butane Pressure as a Function of Temperature
Vapor Pressure (PSIG)
Temperature (F)
n-Butane
Iso-butane
0
10
20
30
40
50
60
70
80
90
0
20
40
60
80
100
120

## Boiling Point as a Function of Pressure



# Terpenator Operating Schematic for Distillation




**NOTICE: ALWAYS OPERATE IN AN <u>EXTREMELY WELL VENTILATED AREA</u>**

**<u>WITH NO IGNITION SOURCES</u>**

## 1.0 DISTILLATION:

### Cleaning Residual Contaminants From Solvents before use:

**Only fill Butane Storage Tank half full. (25lbs in a 50lb tank or 15lbs in a 30lb tank)**

****For processes using Alkane refrigerants such as R-600(Butane), R-600A(Isobutane), or R-290(Propane), even 99.99% purity can still have 10,000 Parts Per Millionth contamination from other gases or longer chain molecule gases.****

***Injecting the refrigerant into the injection port, and recovering the "distilled" gas as normal, will leave any heavier residuals behind in the lower Terpenator collection pot, where they can be cleaned out with denatured alcohol.***

1.1 Put on personal protective equipment (PPE).

Anti-static clothing, eye protection, gloves, foot protection, etc.

1.2 Turn on ventilation/exhaust and gas detection systems.

(Refer to Authorities Having Jurisdiction (AHJ) on setting up a properly ventilated room.)

1.3 Attach hoses and pressure gauge. (**Refer to Bi-Directional Assembly Guide to attach Bi-Directional Modification.)**

- ⅜" hose from Butane Supply Tank ➔ Input Valve #4 on MK 3
- ⅜" hose from Recovery Valve #5 on MK 3 ➔Filter Dryer➔ In on Recovery Pump
- ⅜" one foot hose Out on recovery pump ➔ 3-way "T" with vacuum valve #6
- ⅜" hose from 3-way "T" with vacuum valve #6 ➔ In on chiller coil
- ⅜" hose Out of chiller ➔ to vapor on recovery tank.
- ¼" hose from Vacuum Valve #1 on MK 3 ➔ Vacuum Pump (usually a refrigerant charging hose, not a stainless steel braided hose)
- Pressure gauge ➔ connection without a valve on the 4-way cross on MK 3

1.4 Inspect system to verify:

- Clamps are installed and tightened properly

{Viton Gaskets~44 inch pounds; PTFE Gaskets~50 inch pounds}

- Clamp joints are aligned properly
- Hoses and fittings are properly connected and tightened. {Hand tighten first, then use two wrenches to secure, so as to not disturb any of the PTFE taped pipe thread connections.}
- Stainless steel nuts are hand-tightened behind wrench-tightened brass nuts on collection vessel clamps. This is to prevent the clamp from coming apart in the event of overtightening a brass nut and stripping the threads.

1.5 If this is the first time filling your tank follow these steps, if not then skip to 1.6

- Open Liquid Valve on the Butane Storage Tank to release Nitrogen.
- Attach Vacuum Pump to Liquid Valve on Butane Storage Tank with ¼" refrigerant charging hose.
- Turn on Vacuum Pump and pull the tank down to a full vacuum.
- Close Liquid Valve on the Butane Storage Tank.
- Turn off Vacuum Pump and remove ¼" hose from Liquid Valve on the Butane Storage Tank.

1.6 Set the scale on a sturdy level surface and turn it on.

1.7 Put Butane Recovery Tank into an ice bath.

1.8 Place MK 3 in warm water.

1.9 A column is not needed during the distillation process, but may be used. Make sure the end cap connected to the hose is clamped on the extractor.

1.10 Open all valves on MK 3.

1.11 Turn on Vacuum Pump and allow it to pull system down to full vacuum.

1.12 Close Vacuum Valve #1, Input Valve #4, and BiDirectional Valve #7.

1.13 Remove vacuum hose and turn off Vacuum Pump. (Always close valve and remove hose before turning off Vacuum Pump to prevent vacuum pump oil from being pulled up the hose.)

1.14 Vacuum lines between recovery pump and recovery tank.

- Attach Vacuum Pump to Vacuum Valve #6 on 3-way "T" using ¼" refrigerant charging hose.
- Turn on vacuum pump and pull the lines down to a full vacuum.
- Close vacuum valve #6.
- Turn off Vacuum pump and remove ¼" refrigerant charging hose from valve #6. (An extra gauge may be attached here to read pressure in this region.)

1.15 Open Vapor Valve on Butane Recovery Tank.

1.16 Turn on Recovery Pump.

1.17 Put Butane Supply Tank on the scale and tare it (bring it to zero).

1.18 Open valve on Butane Supply Tank.

1.19 Open Input Valve #4.

- You will notice the scale losing weight as butane leaves the Butane Supply Tank.
- For a 6x6 collection pot allow a MAXIMUM of 2lbs of butane to leave the Butane Supply Tank.
- For a 6x12 collection pot allow a MAXIMUM of 4lbs of butane to leave the Butane Supply Tank.

1.20 Close Input Valve #4 when desired amount of butane has left the Butane Supply Tank.

1.21 Allow Recovery Pump to pull system down to -10inHg.

- Repeat steps 1.19 to 1.21 until you have ~14lbs of butane for a 30lb tank or 24lbs of butane for a 50lb tank.

1.22 Close valve on Butane Supply Tank.

1.23 Open Input Valve #4 to clear the hose.

1.24 Remove MK3 from warm water.

1.25 Allow Recovery Pump to pull system down close to -20inHg.

1.26 Close all valves and turn off Recovery Pump.

1.27 Remove all hoses.

- There will usually be some butane left in the hose connected from the outlet of the Recovery Pump to the Butane Recovery Tank. In order to recover the remaining butane in the line, we need to warm the line and cool the recovery tank so that the butane will move passively from the lines to the tank. Remove the coil from the ice water and place it in hot water.

1.28 Open Input Valve #4 and Dump valve #3 to equalize the pressure in the system.

1.29 Wipe off any water from the lid assembly.

1.30 Remove the lid assembly and place it to the side or on the next Collection Pot to be used.

1.31 Thoroughly clean interior of collection pot with alcohol to remove contaminants.

## 2.0 SETUP

2.1 Set the scale on a sturdy level surface and turn it on.

2.2 Record the weight of the butane storage tank and make sure there is at least 2lbs more butane in it than required to complete the extraction.

- This is to ensure we have enough LIQUID butane for the extraction.

| Column Size | Lbs of Butane Required to Fill Column @4.2g/in$^2$ | Lbs of Butane Required for Extraction | Lbs of Dry Ice Required for Dewaxing Column Sleeve |
|---|---|---|---|
| 1.5x12 | .38 | .76 | N/A |
| 1.5x18 | .57 | 1.14 | N/A |
| 1x5x24 | .76 | 1.52 | N/A |
| 1.5x36 | 1.14 | 2.28 | ~5 |
| 2x36 | 2.15 | 4.3 | N/A |
| 3x18 | 2.32 | 4.64 | ~9 |
| 3x36 | 4.64 | 9.28 | ~18 |

2.3 If there is an insufficient amount then refer to “Distilling Butane”

2.4 Turn scale off to save battery.

2.5 Ball up 3-6 unbleached coffee filters and pack them inside one end of the column that is going to be used.

2.6 Then place a 150 mesh screen gasket and an end cap on the same end of the column and attach them with a clamp.

2.7 From the open end of the column, use a dowel rod to tamp the filters down against the screen gasket.

2.8 Using a funnel, if necessary, slowly pour material into the column and tamp it down with the dowel rod as you go.

- Use very little arm strength when tamping to avoid over packing and difficulties emptying the column when done.

2.9 Fill column within an inch of the top.

2.10 Then ball up 3 more unbleached coffee filters and put them in the top of the column followed by a 150 mesh screen gasket.

2.11 Place warm water reservoir on the ground where the extraction will take place.

2.12 Then place a spacer in the bottom of the reservoir.

2.13 Ensure that the clamps on the bottom and top of the MK3 collection pot are tight.

2.14 Put MK 3 into the warm water reservoir, on top of the spacers.

2.15 Place the storage tank and coil in ice and water reservoirs, fill the remainder of the reservoirs with ice then water (stainless coils can be used with dry ice), and carefully place the tank reservoir on the scale.

2.16 Turn column over and attach open end to the MK3 above Input Valve #4.

2.17 Remove end cap from what is now the top of the column and replace it with the end cap that has a hose running from it to Liquid Valve #2 and the sight glass if applicable.

2.18 Attach hoses and pressure gauge. **(Refer to Bi-Directional Assembly Guide to attach Bi-Directional modification.)**

- ⅜” hose from Liquid valve on Recovery Tank ➔ Input Valve #4 on MK 3
- ⅜” hose from Recovery Valve #5 on MK3 ➔Filter Dryer➔ In on Recovery Pump
- ⅜” one foot hose Out on recovery pump ➔ 3-way “T” with vacuum valve #6
- ⅜” hose from 3-way “T” with vacuum valve #6 ➔ In on chiller coil
- ⅜” hose Out of chiller ➔ to vapor on recovery tank.
- ¼” hose from Vacuum Valve #1 on MK3 ➔ Vacuum Pump (usually a refrigerant charging hose, not a stainless steel braided hose)
- Pressure gauge ➔ connection without a valve on 4-way cross on MK3

2.19 If using a “Dewaxing Column”, using proper PPE, crush dry ice into powder and make sure to chill your alcohol beforehand to use less dry ice. Mix dry ice powder/alcohol at approximately a 1/1 ratio. Fill column's sleeve up one quarter with dry ice powder and ,using a funnel, slowly pour in dry ice/alcohol mix to fill.

## 3.0 PROCESSING

3.2 Turn on ventilation/exhaust system and put on personal protection equipment (PPE). {Refer to Authorities Having Jurisdiction (AHJ) for setting up a properly ventilated room.}

3.3 Open all valves on MK 3 and recovery pump.

- Keep valves on Butane tank closed.

3.4 Turn on Vacuum pump and allow it to pump the system down to full vacuum.

- Value is dependent on your altitude. E.g. Denver ≈-25inHg San Diego ≈-29inHg
- Double Check by closing vacuum valve on machine to listen for a pitch change on the vacuum pump.

3.5 Close Dump Valve #3, Vacuum Valve #1, Input Valve #4, and BiDirectional Valve #7.

3.6 Remove vacuum hose from the MK 3 and turn off the vacuum pump.

3.7 Vacuum lines between recovery pump and recovery tank.

- Attach Vacuum Pump to Vacuum Valve #6 on 3-way “T” using ¼” refrigerant charging hose.
- Turn on vacuum pump and pull the lines down to a full vacuum.
- Close vacuum valve #6, remove ¼” refrigerant charging hose, and turn off vacuum pump.

3.8 Open valves, liquid and vapor, on the Butane tank.

3.9 Turn on scale and wait for it to read zero

3.10 Turn on your Recovery pump.

3.11 Open Input Valve #4.

- You will notice the scale reading going down as butane fills the column.

3.12 When you feel liquid reach the top of the column, or see it in the sight glass, record the amount of butane required to fill the column as “Column Soak Weight” (E.g. 1LB) and close Input Valve #4.

3.13 Open Dump Valve #3 to allow the column to drain down to the collection pot.

3.14 Fill the MK3 water reservoir with water that is approximately 85°F and attempt to maintain this temperature throughout the recovery process.

3.15 Allow recovery pump to pull the system down to approximately -10inHg to remove the butane liquid from the collection pot to open up liquid capacity for the next column fill.

- Maintain water bath temp of about 85° to 95°F and ice packed around the recovery tank throughout the recovery process.

3.16 Tare scale and allow it to zero out.

3.17 Close Liquid Valve #2 and open Bi-Directional Valve #7.

- You will notice the scale reading going down as butane leaves the tank.

3.18 When the scale reads the same as “Column Soak Weight” close Bi-Directional Valve #7, and then open Liquid Valve #2.

3.19 Turn off the scale and the liquid valve on the butane tank.

- This is done because we will not be introducing any more butane into the system, so we can save the battery in the scale and prepare to clear out the input hose in a later step.

3.20 Allow recovery pump to pull the system down to -10inHg.

3.21 Close Dump Valve #3. Warm water should now be applied to the column to assist in vaporizing any liquid trapped in the column through the #2 Liquid Valve. (If using a “Dewaxing Column”, drain dry ice/alcohol out, rinse, and fill with water at approximately 100°F.)

3.22 Check to be sure Liquid Valve on Butane tank is off.

3.23 Open Input Valve #4.

- Allows butane in the input hoses to be recovered.

3.24 Remove MK 3 from warm water.

3.25 Allow Recovery Pump to pull down to approximately -19inHg.

3.26 Close all valves on MK 3.

3.27 Turn off Recovery Pump.

3.28 In order to recover the remaining butane in the line between the pump and the recovery tank, we need to warm the line and cool the recovery tank so that the butane will move passively from the line to the tank. Remove the coil from the ice water and place it in hot water.

3.29 Close vapor valve on butane tank.

3.30 Open Input Valve #4, then Liquid Valve #2, to equalize the pressure in the column and the collection pot.

3.31 Dissassemble MK3.

- Be sure to grab screen gasket when removing column from MK3 to prevent any material from falling out of it and into the dump valve.
- Caution: material may contain small amounts of butane vapor. This should be completed in your ventilated extraction room.

3.32 Wipe off any water from the lid assembly.

3.33 Remove the lid assembly and place it to the side or on the next collection pot to be used.

3.34 Dry off the outside of collection pot and take it to the purging area.

## SCRAPING

4.0 Remove the clamp from the bottom of the collection pot and dry remaining water that was under the clamp.

4.1 Carefully separate the sides and gasket from the bottom plate.

- Lift slowly and in a circular motion so that the extract stuck to the sides and gasket fall inward onto the bottom end cap.

4.2 Place collection pot and seal upside down out of the way.

4.3 Use scraper to remove extract from bottom plate.

4.4 Scrape the extract off the gasket and put it on a separate piece of parchment.

- This is done to minimize the possibility of nucleation when making shatter because the scrapings are agitated more.

4.5 Scrape extract from sides of the collection pot using small scraping blades.

- Combine with what was cleaned off the gasket.

## 5.0 CLEAN UP

5.1 Remove Butane Storage Tank from ice bath and place caps on valves.

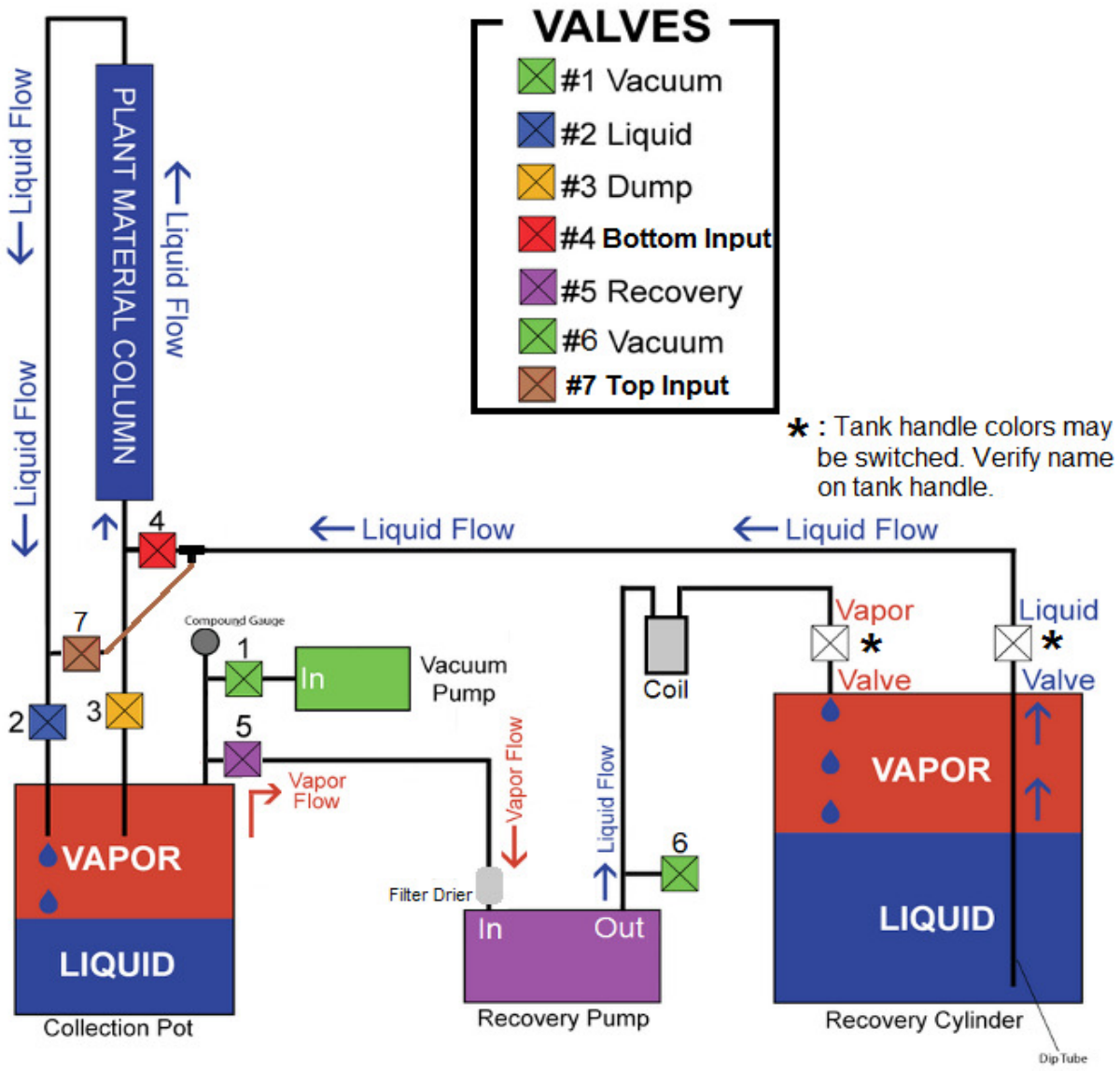
- Store Butane Storage Tank in a cool, dark, safe, and ventilated area.

5.2 Use alcohol and micro-fiber towels to thoroughly clean the lid, sides, gasket, and bottom plate of the collection pot.

5.3 Empty packed dry material column.

- **USE CAUTION.** Flammable Vapors may be present if not completely evacuated.
- Connect the Column Ejector to compressed air or nitrogen, then to one end of the column. Remove 2”x3”/2”x4” reducer from other end to eject spent material. Locate column in safe area. Open compressed air source and open column ejector valve to force material out of the column.

# MK3 Bi-Directional Operating Schematic for Extraction




**NOTICE: ALWAYS OPERATE IN AN <u>EXTREMELY WELL VENTILATED AREA</u>**

**<u>WITH NO IGNITION SOURCES</u>**

# Periodic Maintenance Requirements:

- Follow all maintenance requirements recommended by the original equipment manufacturer relating to all equipment used to support the operation of the MK3.
  (Example: recovery pump; recovery/storage tank, gas detector, ventilation, etc.)
- All equipment used for LP gas transfer must be pressure tested with an inert gas before operating to ensure that it is a leak-tight system.
  (**Including, but not limited to**: MK3 components; hoses and fittings; recovery pumps; recovery tanks; and condensing coils.)
  (If any leaks are detected, they **MUST** be repaired before use) Please do not hesitate to call and talk to a technician with any questions **1-888-572-1911**.
- Valves can loosen up over time and leak from repeated force to the handle. If a valve is found to have a leak, the packing gland nut directly under the handle may need to be tightened. If tightening of the nut does not remedy the leak, then replacement of the valve may be necessary.
- Any components that seem to have attained damage or do not operate properly should be replaced.
- Individual gaskets/seals must be kept clean and replaced if a proper seal cannot be made. Life of seals will largely depend on the intensity of use and conditions they are exposed to. Recommendation: replace every 3-5 weeks of use.
- Brass hex nuts on the double-bolted high pressure clamps should be replaced when visible signs of wear to the threads are observed. Life of brass hex nuts will largely depend on the intensity of use and conditions they are exposed to. Over-tightening will shorten their life span.

# Storage

DO NOT store MK3 with any amount of combustible gas contained inside.

- The unit must be fully evacuated of all solvent/flammable gas before storage.

DO NOT store unit under pressure.

- MK3 and all supporting equipment should be depressurized before storage.

# Specifications

304 Stainless Steel Components
316 Stainless Steel Components
316 Stainless Steel PTFE Encapsulated Water/Oil/Gas (WOG) Valves
Double Bolted High Pressure Tri-clamps:
Viton Tri-Clamp Gaskets (PTFE Upgrade Option-Available for purchase)
PTFE-lined Stainless Steel Braided Hoses with female SAE connections:
(Quick Connect Adapters Upgrade-Available for purchase)
Tri-Clamp Material Columns:
(Column with Dewaxing Sleeve Upgrade-Available for purchase)
Tri-Clamp Collection Vessel:
(Collection Vessel Capacity Upgrade-Available for purchase)