Draught Kombucha Quality Manual

The Draft Kombucha Standards Committee was formed as a Kombucha Brewers International subcommittee of the Special Projects Team in June of 2018. Our mission is to establish standards that take into account Kombucha's unique properties to create a safe and delicious product.

Draft systems may be installed by distributors, wholesalers, retailers, or draft installation teams and once in place, each system commonly pours a wide range of brewers' and suppliers' products. We have sought to bring the industry together to agree upon guidelines that present everyone's Kombucha in an optimal condition.

When handled properly from brewery to bar to glass, draft Kombucha delivers what many consider to be the freshest, most flavorful product available to the customer. However, the job does not end once the keg is tapped and the booch begins to flow. Good Kombucha quality depends on proper alignment of the dispense variables and consistent housekeeping practices.

The Draft Standards Committee focused on these and other areas to develop a clear and well-researched resource of best practices for draft Kombucha. Of course, individual brewers may have additional quality requirements or recommendations for various brands beyond these commonly agreed upon guidelines.

Preface

This first version of the draft Kombucha Quality Standards Manual includes several updates and revisions, and we will continue to refine it in the future. Our goal is to provide useful and current information for all industry members, manufacturers, distributors, retailers, and consumers.

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Acknowledgments

We would like to thank first and foremost, the Brewers Association. Their manual, The Draught Standards Manual, is THE gold standard for best practices for dispensing fermented beverages. Without this invaluable resource, this manual would have required many more hours and a substantial financial investment. Thank you for all of your inspirational and foundational work.

Thank you to our industry colleagues whose continued input allowed for the significant updates included in this edition of this manual. We appreciate their expertise and commitment to consistently deliver the highest possible quality draft Kombucha to the consumer. If we overlooked anyone who contributed, we sincerely apologize.

Special thanks are extended to Jared Gustafson, President of Kombucha on Tap, LLC. As the leading expert on Kombucha on tap, Jared brought together a team to see this manual through a collaborative effort with the brewing community, and we appreciate the time and dedication he and his colleagues put forth to bring this project to fruition.

Spring Branch Kombucha - Chris & Jessica Ollis
Brew Dr. Kombucha - Larry McGrath, Danny Metcalf
Elixir Kombucha - Corey & Danielle Wood
Micro Matic - Dispense Institute Team

First Edition May, 2019

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Kombuchai
ON TAP!

Introduction

A few words from the Draft Standards Committee Head

I began working with kombucha draft systems in early 2014 and even today, there are times I'm troubleshooting something I've never seen before. Kombucha on tap and the draft system standards that surround it are in a constant state of evolving with the growing kombucha industry. It's increasingly more important than ever to have draft system standards in place and know that improvements will continue to transpire as technology advances.

My hope is that this manual helps you offer your customers the best draft experience and allows your employees to feel more confident when it comes to working with draft systems.

Make it a healthy day,

Jared Gustafson
President
Kombucha On Tap

These days Kombucha on tap is popping up in bodegas, bars and grocery stores. Fueled by consumer demand for fresh, delicious Kombucha at an affordable price, on tap and keg sales are increasing dramatically and account for a good portion of a brewers sales. As a newcomer, there are challenges to ensuring the quality of what goes into the keg is maintained all the way through the dispensation process into the consumer's belly.

To that end, we have drafted a guide intended to assist Kombucha producers and those who dispense it on location to provide the freshest, highest quality product. All aspects of the kegging process from equipment to techniques will be covered in this manual.

Of course, we owe a great debt to those who have come before us, especially our friends in the beer industry and dispense components suppliers for providing invaluable information and acting as our comrades in the quest for authentic, traditionally brewed, high quality fermented beverages.

Draft Equipment and Configurations

Draft systems are comprised of three general types based on equipment and design:

- temporary systems
- direct-draw systems
- long-draw systems

In the course of this manual, we look closely at the layout, operation, and maintenance for each system. In Section I of this manual, we present four chapters that focus on the system components from faucets to tubing connectors and explore how they are assembled to create different systems. Along the way, we review important features of each component that can help prevent operating problems or Kombucha quality issues in your system.

Before we jump into the components themselves, let's review some key concepts by looking briefly at the three sub-systems for draft:

- Gas
- Kombucha
- Cooling

Gas

Gas draft systems use either carbon dioxide (CO_2) alone or CO_2 mixed with nitrogen (N_2) in varying proportions depending on the requirements of the system. When properly selected and set, the gas used for dispensing the product maintains the correct carbonation in the Kombucha and helps to preserve its flavor. In most draft systems, the dispense gas also propels Kombucha from the keg to the faucet. Because the dispense gas comes into direct contact with the Kombucha, it must meet strict criteria for purity. **Because of the damage it does, compressed air should never be used to dispense draft Kombucha.** For the purposes of this manual, as a convention in discussions involving mixed gas, the proportion of CO_2 will always be shown first, followed by the proportion of N_2.

Kombucha

Most draft systems use the gases mentioned above to drive Kombucha from the keg, through tubing to the faucet where it will flow into the customer's glass. During the journey from keg to glass, we want to protect the Kombucha from anything that would compromise its flavor or alter the carbonation established by the brewery. The Kombucha should flow through well-maintained proper product lines and **avoid any contact with brass or chrome parts** that would impart a metallic flavor. We also want the Kombucha to flow at a specific rate and arrive with the ideal carbonation level. The key to getting this right is balance between the applied gas pressure and the resistance provided by the tubing and fixtures the kombucha passes through during its journey to the bar.

Cooling

The cooling system should hold Kombucha at a constant temperature from keg to glass. Any increase in Kombucha temperature between the cooler and the faucet can lead to dispense problems such as foaming. In a simple direct-draw system, a refrigerated cabinet maintains the temperature of the keg and provides cooling to the Kombucha as it travels the short distance to the faucet. Many long-draw systems use a walk-in refrigerator to cool the kegs, plus chilled glycol that circulates in tubes next to the product lines all the way to the faucet, to ensure that the Kombucha stays close to the temperature in the cooler all the way to the glass.

For each draft dispense system, suitable equipment and designs must be chosen for each of these three components—gas, Kombucha, and cooling. In Section I of this manual, we examine the equipment used in draft systems and the various system designs commonly employed.

Temporary Systems - Special Event

- Picnic Pump
- Jockey Box - Cold Plates and Coils
- Special Event Trailer

Direct-Draw

- Keg Box
- Walk-in Cooler

Long-Draw

- Beer Pump
- Mixed Gas Dispense
- Forced Air-Cooled or Glycol-Cooled

Chapter 1 examines Nine components common to nearly all draft systems, such as couplers, faucets, and product lines. Understanding these basic elements will help you operate the draft systems you encounter. Of course, additional components play a role in sophisticated systems—we introduce and discuss those, as well as look at the dynamics of carbonation, pressure, and system resistance, as we encounter them in **Chapters 3 & 4**. By understanding these concepts and their relationship with each other, you'll be much better equipped for successful draft system operation.

The simplest draft systems serve a temporary need. We find these systems at picnics, festivals, and other short-term events. In **Chapter 2**, we cover the design, setup, use, and maintenance of the two main systems: picnic pumps and jockey boxes.

Moving to permanent draft installations, direct-draw systems offer the simplest approach. In **Chapter 3,** we talk about the anatomy of a keg box or "kegerator" and discuss how this basic approach is implemented in a walk-in cooler design. Both here and in **Chapter 4,** we find some new components beyond the nine "guidelines" from **Chapter 1.** In each chapter, we learn about the new components before looking at the anatomy of the overall system.

Permanent installations where the kegs cannot be located near the serving bar require long-draw draft systems. **Chapter 4** delves into the anatomy and operation of air-cooled and glycol-cooled long-draw systems, and also looks at Kombucha pumps and mixed gas dispense solutions to moving Kombucha through long- draw dispense systems.

Chapter 1: Essential Draft System Components

Let's review the equipment commonly found in all draft dispense setups, from the Farmer's Market jockey box to the grocery store kegerator. Here are the nine components:

1. Refrigeration/Cooling
2. Cornelius Kegs
3. Keg and Keg Valves
4. Coupler
5. Tail Pieces and Connectors
6. Faucet Designs - Standard and Ventless
7. Gas Source
8. Regulator
9. Pressure and Pressure Gauges
10. Gas Line

Refrigeration/Cooling

Refrigeration systems for Kombucha are typically air cooled condensers.

Air Cooled Condensers

- Can lose significant cooling capacity on a hot day when it is needed most in warm climates
- Remote mounting of the compressor

Proper preventive care is imperative

- Regularly cleaning condenser fins
- Acid cleaning or "roding" out the heat exchanger may be required

Coolant Types

- R22 refrigerant is still in use
- Most new installations utilize a more environmentally friendly substitute such as 404a

For consistent and controlled Kombucha dispense, it requires that the Kombucha traveling from keg to glass be maintained at a temperature of 34° to 38°F. While temporary service may employ ice for cooling, most permanent installations employ refrigeration systems.

Cold box refrigeration systems can provide cooling for a small direct-draw box cooler or a large walk-in. The refrigeration itself can either be self-contained with the compressor and condenser mounted on the unit or with a remotely mounted compressor and condenser. Remotely mounting the compressor can be done for air-cooled systems but it diminishes cooling capacity. Acid cleaning or "roding" out the heat exchanger may be required to remedy this.

Many draft system problems are revealed on the first hot day of the season due to a lack of preventive maintenance. Although R22 refrigerant is still in use, most new installations will utilize a more environmentally friendly substitute such as 404a.

Glycol systems are also used, as we'll see when we examine long-draw systems.

Kegs and Keg Valves

Kegs enable Kombucha transport in bulk and dispense by the glass while maintaining its quality and integrity. Their design protects Kombucha from both air and light while enabling easy and rapid dispense. Most brewers use kegs made of stainless steel, but you also see single-use kegs manufactured from various materials including food grade plastic and utilizing differing technologies.

When tapped, the keg’s valve admits gas to the head space where it applies the pressure needed to push Kombucha up through the spear or down tube and out of the keg through the coupler, while maintaining correct carbonation in the remaining Kombucha.

Drop-In Valve - Secured by Lock Ring

Threaded Valve - Screws Into keg

DRAFT SAFETY! Kegs are pressurized vessels and can be dangerous if mishandled. Nearly all modern kegs use some form of Sankey valve and stem. There are two main types of Sankey valves and corresponding keg necks: “drop-in” and threaded. From a user standpoint, the valves function identically; from above, they appear nearly indistinguishable to the untrained eye. Drop-in Sankey valves are held in place by a lock ring or circlip.

WARNING - The lock ring and valve should never be removed in the field because keg pressure could cause the value and downtube to rocket upward with high velocity. Very rarely, a lock ring can fail, possibly loosening the valve, creating a potentially dangerous situation. Threaded Sankey valves screw into the neck of the keg. Very rarely, a threaded valve can inadvertently loosen or become unseated when disengaging a coupler, creating a potentially dangerous situation. Keg valves should never be removed in the field. Kegs should only be serviced by trained personnel. New o-rings and lock-rings should always be installed when replacing a keg valve. All new parts should be supplied by, or approved by, the keg valve manufacturer.

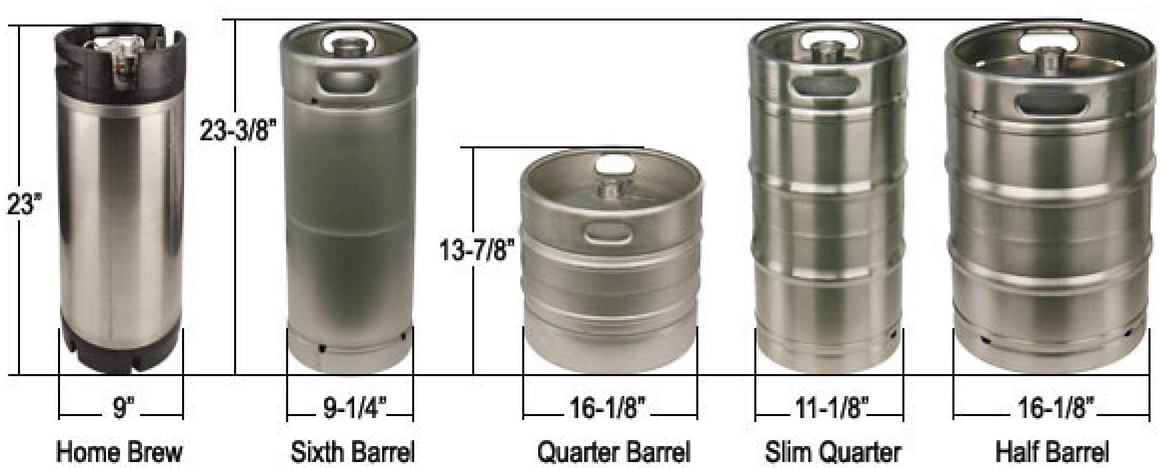
Cornelius Kegs (Soda Kegs)

Cornelius (or corny) kegs are incredibly popular in the homebrewing community for both beer and Kombucha. For small scale production, the Cornelius keg has a number of advantages:

- Large opening for filling and cleaning
- Ability to use as a primary or secondary fermentation vessel
- Ability for force carbonate
- Long life cycle (many in use today are 30+ years old)
- Relatively inexpensive to service and clean (no expensive equipment required)

Special consideration must be given to a draft system when using Cornelius kegs. Ball-Lock or their brethren, Pin-Lock Kegs **do not have Check Valves (One-way Valves)** built into the kegs or keg connectors. Kombucha could enter the gas system if keg pressure and system pressure are not properly maintained. Kombucha entering the gas system can lead to the following problems:

- Cross contamination between kegs on draft system
- Fouling the air distributor and regulator(s)
    - Regulators will not function properly after liquid enters them requiring costly replacement.
    - Air distributors full of liquid could freeze if mounted near the kegerator evaporator. This could prevent gas from reaching kegs and ultimately stop the flow of product to the faucet.
- Contamination of gas line with live cultures
    - Need to replace the gas system components.



Capacity	Corny/Sankey Keg (⅙ Barrel)	⅙ Barrel or Cylinder	Pony Keg ¼ Barrel	¼ Barrel	Full-size Keg (½ Barrel)
Gallons	5-5.16	5-5.16	7.75	7.75	15.5
Ounces	661	661	992	992	1984
# of 12oz cups	55	55	82	82	165
Weight (Full)	58 lbs	58 lbs	87 lbs	87 lbs	161 lbs

Couplers

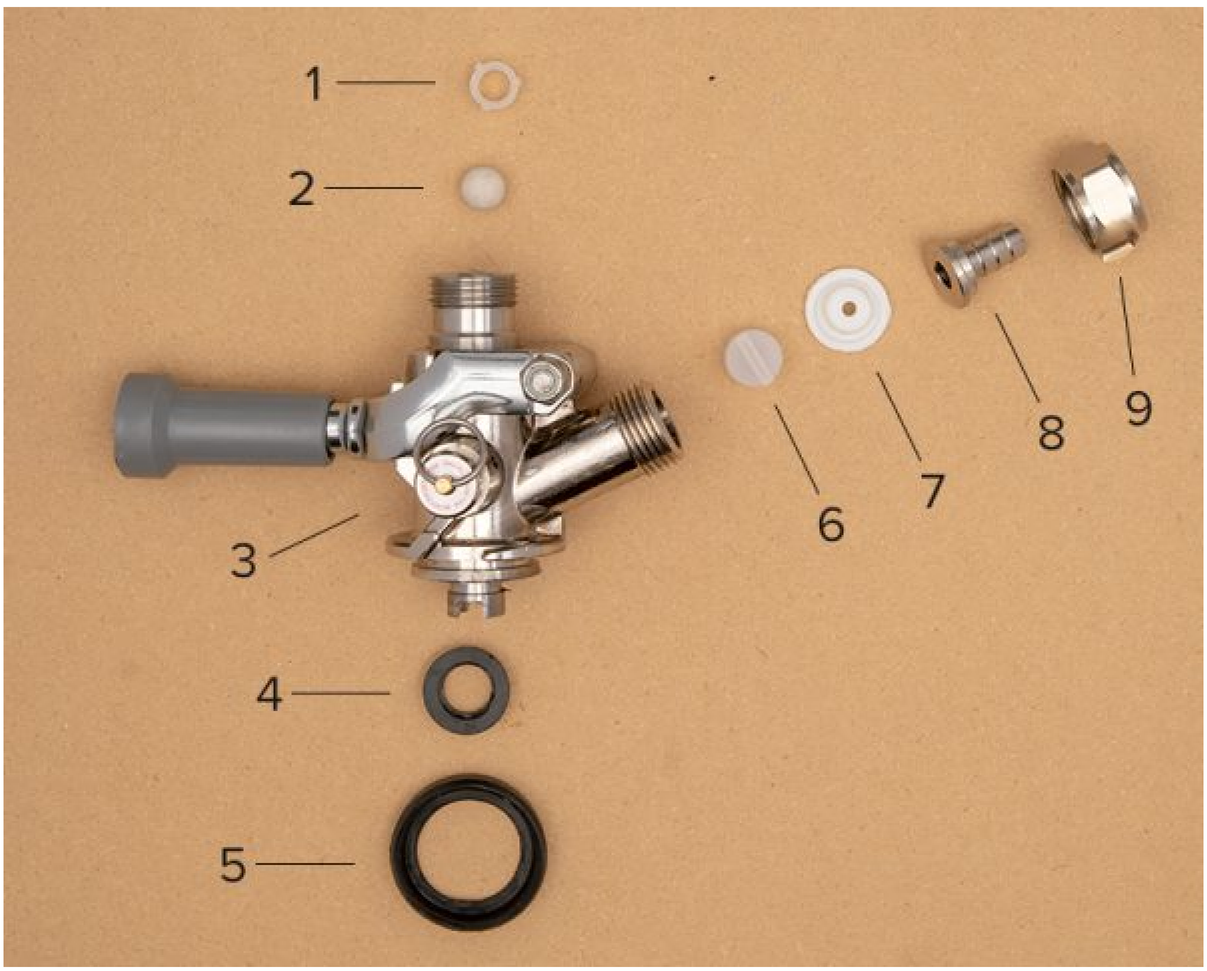
 A Coupler	 D Coupler	 G Coupler
		

 M Coupler	 S Coupler	 U Coupler
		

Gas flows in and Kombucha flows out of a keg through the coupler, also known as a keg tap. When you attach a coupler to a keg to tap it, a probe depresses a ball, or poppet, in the keg valve, allowing CO_2 or mixed gas to enter the keg, thereby applying pressure to the Kombucha. This forces the Kombucha to travel up the down tube (spear) and drive the Kombucha to the faucet. If the keg coupler isn't properly attached, nothing will come out of the keg.

The coupler is typically attached to a flexible vinyl product line, referred to as a jumper line, using a washer, tailpiece, and hex nut. Check for leaks after installing a product nut onto any coupler. Most U.S. breweries use the Sankey "D" coupler, unless otherwise noted.

In the U.S., the threads on product nuts and couplers are standard sized at 29/32" diameter, and 14 threads per inch pitch. Be aware that some couplers from other countries may use different sized threads.



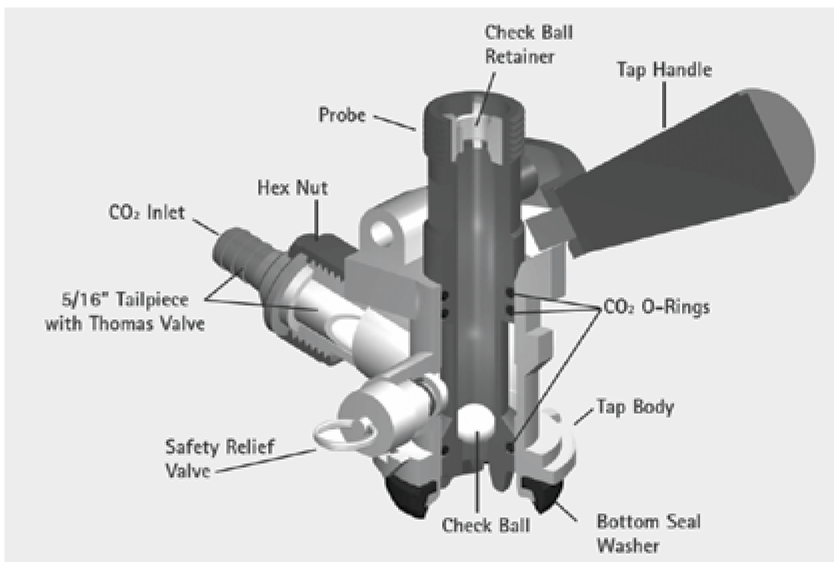
1. Check Ball Retainer
2. Check Ball
3. Keg Tap and Tap Lever Handle
4. Probe Seal
5. Body Seal

6. Thomas Valve
7. Retainer for Thomas Valve
8. Stainless Steel Tail Piece for 5/16” Vinyl Hose
9. Hex Nut for Beer Line – ⅜” Bore

Couplers include two types of one-way valves:

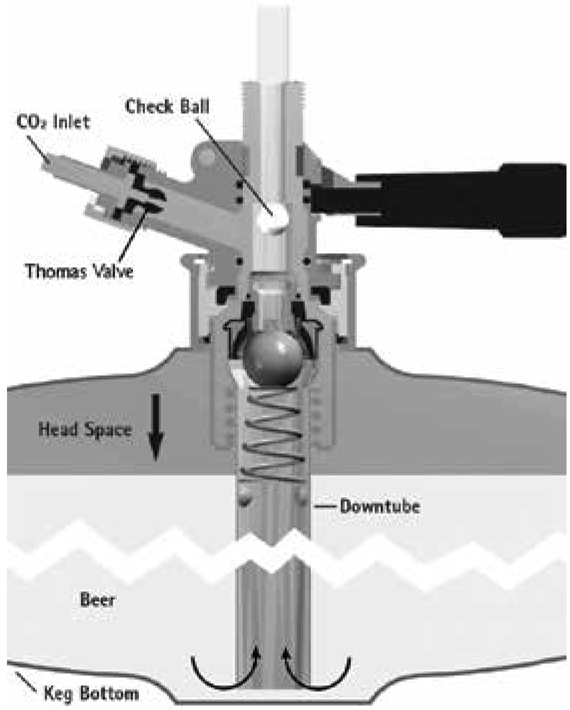
- **Thomas valve** – This valve allows CO2 to flow into the keg but prevents the Kombucha from backing up into the gas line if gas pressure drops. This protects the gas regulators from damage. (Thomas valves are removed when kegs are dispensed in series; see page 17)
- **Check valve** – When the coupler is disconnected from the keg, this valve prevents Kombucha from the product line flowing out through the coupler. This prevents Kombucha spillage in keg tapping areas.

Cut-away of Sankey “D” Coupler



A keg coupler should also contain an integral pressure relief valve also referred to as a **safety relief valve**. If excessive gas pressure were applied to a keg, this valve should open to prevent injury and damage to the keg and coupler. The valve can also be opened manually. This should be done periodically to test the safety relief valve. The manual release usually looks like a small metal pin fitted with a wire ring. To test the valve, pull on the ring to slide the pin a short distance out of the coupler and release a small amount of gas.

How Coupler Interacts with Keg to Draw Kombucha



Tail Pieces and Connectors

For many years, suppliers made metal parts for draft systems with chrome-plated brass. **Chrome plating is not suitable for use with Kombucha due to potential corrosion.** Chrome-plated brass components should not be used with Kombucha.

In order to be compliant for equipment certification for use with Kombucha, **all Kombucha brewers, distributors and retailers must use only Type 304 or higher stainless steel parts for draft dispense.** In addition to being inert, stainless steel parts are easier to clean and help to maintain high quality draft dispense. Manufacturers offer all faucets, shanks, tail pieces, splicers, wall brackets, and probes mentioned in this manual in stainless steel. **If your system already contains chrome-plated brass components, they should be switched out for stainless steel versions ASAP.**

Product & Pressure Line

Between coupler and faucet, Kombucha travels through product lines selected to fit the needs of the specific draft application. Options range from vinyl to specialized barrier tubing and even stainless steel.

Most draft systems use clear vinyl tubing for all or part of the product line. It's inexpensive and easy to find but notorious for curling at the end. Add an extra foot of length to the amount of tubing needed in order to account for curling.

Clear, vinyl tubing

In hand-pump and direct-draw systems, Kombucha often runs most or the entire route from coupler to faucet in vinyl tubing. In long-draw systems, Kombucha commonly passes through two different sections of vinyl hose but travels most of the way through special barrier tubing (See Chapter 4). While vinyl tubing is highly flexible, it is best used where lines are not secured in place and where it can easily be replaced.

Other types of tubing will be discussed as the topics for their use present themselves.
- Colored vinyl and braided vinyl used for CO2 gas
- Stainless steel tubing found in jockey boxes and tap towers
- Barrier tubing; a low-resistance, easy-to-clean product line for long-draw systems
- Polyethylene tubing used to carry glycol coolant

All system components should be designed to facilitate cleaning and to preclude contamination, particularly due to microbial growth.
- Avoid indentations, recesses, dead space, and gaps
- If dead spaces cannot be avoided at the junction between tubing and fittings
    - depth should be smaller than the smallest dimension of their cross section to facilitate cleaning
- Edges at protrusions, transitions, and extensions should be rounded
- Components should be designed so they permit an unobstructed flow of liquids and are easy to drain

Faucet Designs - Standard and Ventless

Faucets dispense Kombucha into the glass. They often hold the tap marker to identify the type of Kombucha being dispensed. These are the two most common faucets used in the industry and are generally suitable for dispensing most Kombucha.

Rear Sealing

- Considered the "standard" U.S. faucet
- Has vent holes that need to be carefully cleaned and inspected during routine cleanings
  - Provide back pressure for smooth Kombucha flow
  - Permits the faucet spout to drain between pours

Forward-sealing faucets

- Also called ventless
- Easy to clean

Nitro-Kombucha faucets

- Not common at this time
- Use a diaphragm and restrictor plate to "cream" the Kombucha

Several other designs are widely available and are used either for their aesthetic appeal or for serving a specific style of Kombucha.

In the U.S., all faucets attach to shanks with a **standard thread size of 1-1/8" diameter, and 18 threads per inch pitch.** Be aware that some faucets from other countries may use different thread sizes, and may require adapters or special shanks. For example, the flow control faucet in the chart below is shown with an adapter to allow it to be used on a standard U.S. shank and tower.

Faucts (left to right): Standard, European, Flow Control, Stout, Ventless

At retail, most faucets are fitted with tap markers that clearly display the brand being dispensed which is a requirement in many states. The tap marker must be aligned properly in order to be read easily by the consumer and sales staff. The tap marker is fitted with a standard-sized threaded sleeve for easy installation onto the faucet lever.

In many cases, however, the tap marker may not be aligned properly when seated fully on the lever. For this reason, nearly all faucets are also fitted with a lever collar or handle jacket on the lever. These allow the tap marker to be aligned properly, as well as installed securely.

When installing the tap marker on the faucet lever, check to make sure it's aligned properly. If not, unscrew the marker just enough to align it correctly. Using pliers on the lever collar, back it up under the marker and hand tighten the tap marker snugly onto the lever collar or handle jacket.

Gas Source

Draft systems depend on gas pressure to push Kombucha from the keg to the faucet. To achieve this, kegs should be pressurized with carbon dioxide (CO_2), or a carbon dioxide and nitrogen (N_2) mix. Consult Chapter 4 to determine the proper blend of CO_2 and N_2 for individual applications.

Gas used for draft dispense should be "beverage grade." Gas selection and purity affect the freshness and quality of the Kombucha served through the draft system. Remember: the gas you use fills the keg as the Kombucha drains. Thus, off-flavors or impurities in the gas quickly migrate to the Kombucha to spoil its freshness and flavor.

Compressed air should never be used to pressurize a keg as the oxygen in the air generates off flavors in Kombucha within just a few hours. All gas used for Kombucha dispense should meet the specifications of the International Society of Beverage Technologists or the Compressed Gas Association (See Appendix A).

Retailers may purchase beverage grade gas in cylinders that are delivered by the gas vendor and swapped out when empty. Such cylinders are filled, maintained, and inspected by the vendor. High volume users may purchase a bulk gas vessel known as a Dewar that will be filled on location from a bulk gas truck. Bulk tanks can provide CO_2 for soda, beer and Kombucha.

CO_2 tanks contain both liquid and gas phases. The tank pressure is dependent on ambient temperature and— regardless of tank fill level—will vary from 600 – 1200 psi until empty. For safety reasons, **CO_2 tanks should never be located inside the refrigerator or walk-in cooler** as a leak could fill the space with deadly carbon dioxide. It also decreases yield over CO_2 stored at ambient temperatures.

A gas filter may be installed to help reduce the likelihood that any contaminants in the gas reach the Kombucha (be sure to follow manufacturer recommendations for filter maintenance intervals; see page 16 for more information). Gas line should be selected to withstand the pressures in the draft system.

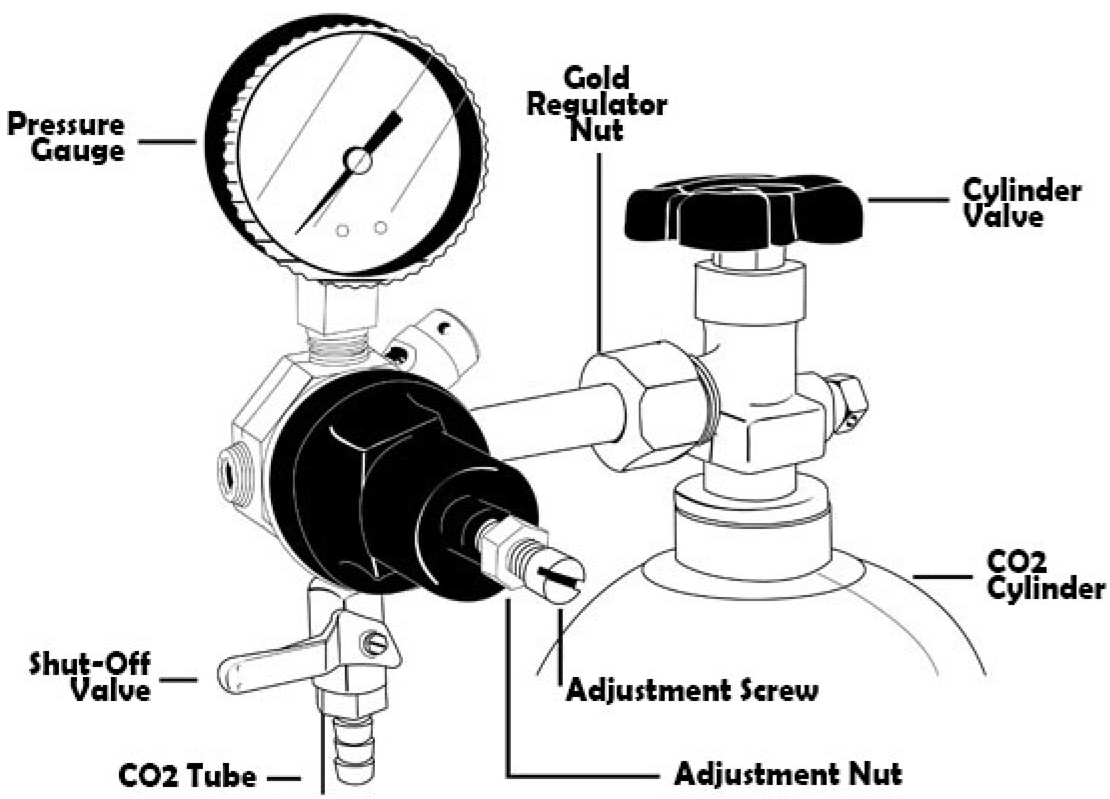
Vinyl tubing used as gas line often has a greater wall thickness than vinyl product line tubing. To help distinguish between gas line and product line, colored vinyl is usually used for CO_2 supply line. Colored vinyl should not be used for Kombucha because it prevents visual inspection. An exception to this rule would be line exposed to sunlight, like what you might see in a temporary festival outdoor system poured off a jockey box.

Clear vinyl may also be used for the gas line as it aids in troubleshooting by allowing you to see if Kombucha has escaped the coupler and entered the gas line due to a faulty or missing Thomas valve. Translucent colored gas line is common. Because vinyl gas line will fail at lower pressures than braided vinyl or poly, it can also serve an important safety function in the event of secondary regulator failure by rupturing before a keg becomes over-pressurized.

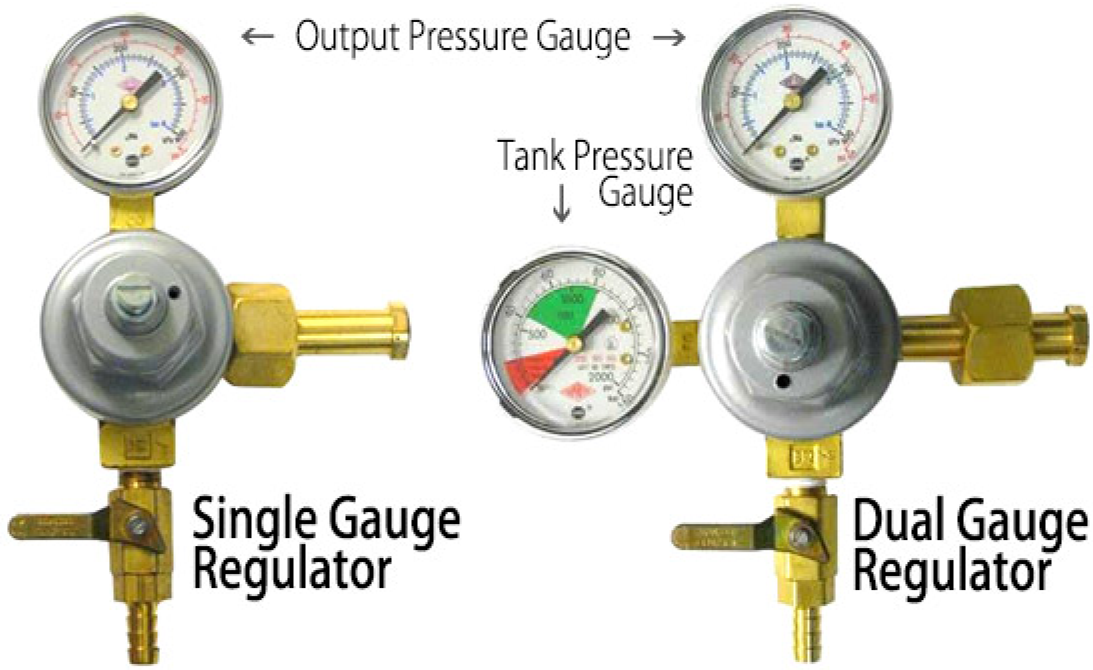
Cornelius kegs do NOT have check valves so they are much more susceptible to loss of product. **KBI recommends check valves be installed on the gas vinyl line attached to cornelius kegs** to prevent Kombucha from entering the gas system or cross contaminating other kegs.

Braided vinyl is often used for CO_2, particularly in high pressure situations (50+ psi) and in long CO_2 runs. Braided vinyl is commonly used in soft drink lines for both beverage and gas as well as in ball lock kegs from the check valve to the ball lock coupler to avoid damage to the line. While not as easy to work with, braided vinyl can also be used with Sanke kegs as well.

Regulator



A regulator adjusts and controls the flow of gas from any source. Each regulator typically has at least one, and often two pressure gauges that help in setting the outlet pressure and monitoring the gas level in the tank. Valves and an adjustment screw control the actual flow of gas from source to destination.



Images from kegerator.com

All gas systems employ a primary regulator attached to the gas source, namely a portable bottle or bulk tank. This regulator typically contains two gauges:

- one high-pressure gauge showing the tank or supply pressure
- a second low-pressure gauge showing what is being delivered to the keg.

Some simpler regulators may contain only one gauge displaying the delivered pressure, making it more difficult to predict when the bottle is getting low. A gauge cage should be installed to protect gauges in an installation where they may be vulnerable to damage.

Gauge cage - Image from Great Fermentations

Regulators are attached to the gas bottle with either an integrated "O" ring seal in the face of the regulator fitting, or a fiber or Teflon flat washer. **These should be inspected every time the bottle is changed** and they need to be replaced occasionally to prevent leaks.

Many regulators are also equipped with one or more shut-off valves located on the low-pressure outlet, allowing the CO_2 to be shut off without changing the set-screw or shutting off the main tank valve.

A primary regulator must also contain a safety relief valve to prevent dangerous system pressures in case of a malfunction or frozen regulator. Bottled CO_2 pressure can exceed 1000 psi, creating an extreme hazard if not handled properly.

Nitrogen regulators are designed for higher pressures and have a male thread with a conical fitting that (depending on the design) seats to the gas source with or without an "O" ring.

Pressure and Pressure Gauges

For the purposes of this manual, pressure is defined as the amount of force acting on the surface of Kombucha in a keg or serving vessel. It is often expressed in pounds per square inch (psi). **Absolute pressure** is the total pressure on the Kombucha, and is the sum of atmospheric pressure plus any additional applied pressure from dispense gas. **Atmospheric pressure** is the amount of force exerted by the weight of air in the Earth's atmosphere above an object. At sea level, atmospheric pressure is equal to 14.7 psi. If the dispense gas is applied at 15 psi, then the absolute pressure on the Kombucha is 29.7 psi (14.7 psi + 15 psi).

Pressure can be measured several ways. Most pressure gauges are designed to measure the pressure of the dispense gas applied to Kombucha beyond the local atmospheric pressure level. This is called **gauge pressure** or psig. Gauges in draft Kombucha systems will nearly always read in psig. (Some specialized gauges are designed to measure the total pressure on the Kombucha, or absolute pressure, in units of psia; these are very rare in draft Kombucha dispense systems.)

As draft Kombucha is dispensed, **the carbonation level will depend on the absolute pressure of the dispense gas, not the gauge pressure of the dispense gas.** This is true for both straight CO_2 as well as blended gas. The carbonation level in a Kombucha is set by the brewer to maximize flavor, aroma, and presentation.

One goal of draft Kombucha dispensing is to maintain carbonation level. If the absolute pressure of the dispense gas is too high, the carbonation level of the Kombucha will increase over time. If the absolute pressure of the dispense gas is too low, the carbonation level of the Kombucha will decrease over time. More information about this very important topic can be found in Appendix C.

A Few Words about Elevation

Atmospheric pressure changes depending on elevation, and therefore so does the absolute pressure. Elevation needs to be taken into account while designing draft Kombucha dispensing systems and when reading carbonation tables. At higher elevations, the air is thinner and therefore weighs less, so atmospheric pressure is also less. **A good rule of thumb is that atmospheric pressure decreases by about 1 psi per 2,000 feet in elevation.**

EXAMPLE:
Let's say the ideal dispense gas pressure for a Kombucha brand in a particular draft Kombucha system at sea level is determined to be 15 psig. At sea level, atmospheric pressure is equal to 14.7 psi, so at sea level a keg of Kombucha with dispense gas pressure of 15 psig is under an absolute pressure of 29.7 psia (15 psig + 14.7 psi). That same keg of Kombucha at an altitude

of 5,000 feet with the same dispense gas pressure of 15 psig is only 27.2 psia (15 psig +14.7 psi – 2.5 psi). The chart below illustrates the absolute pressure on a keg of Kombucha at different elevations, assuming 15 psig dispense gas pressure.

Even though the gauge pressure on the keg of Kombucha reads the same, the absolute pressure of the dispense gas on the keg is decreasing with elevation. Over time, the carbonation level of the Kombucha being dispensed at elevation will slowly decrease because the absolute pressure of the dispense gas is lower than at sea level.

The charts below illustrate that in order to maintain the carbonation level of Kombucha being dispensed at elevation, the gauge pressure of the dispense gas needs to be increased above the calculated dispense pressure at sea level.

Elevation (feet above sea level)	Atmospheric Pressure (PSI)	Dispense Pressure (PSIG)	Absolute Pressure (PSIA)
0	14.7	15	29.7
2,000	13.7	16	29.7
4,000	12.7	17	29.7
5,000	12.2	17.5	29.7
8,000	10.7	19	29.7
10,000	9.7	20	29.7

Elevation (feet above sea level)	Atmospheric Pressure (PSI)	Dispense Pressure (PSIG)	Absolute Pressure (PSIA)
0	14.7	15	29.7
2,000	13.7	15	28.7
4,000	12.7	15	27.7
5,000	12.2	15	27.2
8,000	10.7	15	25.7
10,000	9.7	15	24.7

Chapter 2: Temporary Draft Dispense

Kombucha goes great with outdoor events, but the temporary setting prohibits use of traditional direct-draw or long-draw draft equipment. Instead, we usually use one of two different systems: **hand pumps or jockey boxes**. Direct-draw type systems are utilized for special event dispensing. Example would be a shank with faucet mounted on a large container holding keg and ice.

Hand Pumps

Hand pumps allow draft Kombucha dispense for a one-day occasion or event. These systems compromise accepted standards of draft dispense in order to offer a simple method for serving draft Kombucha.

In the simplest systems, the Kombucha flows to a simple plastic faucet attached to short section of vinyl hose. Gas pressure comes from compressed air introduced by way of a hand-operated pump integrated into the coupler. The pictures show plastic and metal examples of hand pumps.

Since these systems introduce compressed air into the keg, they are suitable only for situations where the Kombucha will be consumed in a single day. Also, these dispensing systems typically do not produce the best serving results, since balancing the correct top pressure is very imprecise. **For best results, the keg must be kept in ice and consistently—but not excessively—pumped as the contents are dispensed.** Pumping the keg with the faucet closed will only serve to build up pressure into the head-space, encouraging the absorption of oxygen into the Kombucha.

Improved designs use single-use CO_2 cartridges with an integrated regulator. These units may also include a traditional vented faucet mounted on a short length of stainless steel product line. This design overcomes the key shortcomings of hand-pumped taps.

Jockey Box Setup and Use

Coil-style jockey boxes can pour Kombucha at a faster rate than those equipped with a cold plate due to the relatively high surface area for chilling Kombucha, i.e. Kombucha goes through more tubing length. Thus, they better suit situations where faster pour rates and volumes are needed. With lower surface areas for chilling, the cold-plate style is appropriate when Kombucha dispense needs are a bit slower.

To set up a coil box:

1. **Tap** the keg and run Kombucha through the coil and out the faucet.
2. **Add** ice to the ice chest and completely cover the coil.
3. **Add** cold water to the top of the coil. This creates an ice bath, giving excellent surface contact. Ice water is also a better conductor than straight ice.
4. **Set** CO_2 pressure to 35 to 40 psi on 120 ft. coils. Shorter coils are not recommended, but if used, should dispense at 30 to 35 psi. Since coil length varies, so too will psi. This is usually a trial and error process as opposed to an actual calculation.

Jockey Box with Cold Plate

Jockey Box with Coils

Cleaning and Maintenance

Temporary dispense equipment must be cleaned immediately after use. It is nearly impossible to remove the mold and biofilms that can result from storing a cold plate or jockey box that has had old Kombucha left in the lines.

For cleaning jockey boxes, refer to the detailed electric cleaning pump procedures outlined in Chapter 7. Afterwards, the water in the lines must be blown out to prevent mold growth.

- If the recirculation pump is capable of being run dry:
  - Before breaking down recirculation loop, remove inlet from rinse water with pump running so air pushes out all of the rinse water in the lines.
- If the recirculation pump is **not** capable of being run dry:
  - After breaking down the recirculation loop and reattaching faucets, tap an empty cleaning canister and use the gas pressure to blow all of the water out of the lines.

Chapter 3: Equipment and Configurations for Direct-draw Draft Systems

Retailers use direct-draw systems in situations where the kegs can be kept refrigerated in very close proximity to the dispense point or faucet. In some cases, the Kombucha sits in a cooler below the counter at the bar. In other cases, the keg cooler shares a wall with the bar, keeping the Kombucha close to the point of dispense. Let’s look at these two types of direct-draw systems:

- A self-contained refrigerator (keg box or “kegerator”) where the number of kegs accommodated will vary based on box and keg sizes.
- A walk-in cooler with Kombucha dispensed directly through the wall from the keg to the faucet.

The nine components discussed in Chapter 1 appear in both direct-draw systems; only a little additional equipment is needed. As with temporary systems, **most direct-draw systems employ vinyl product line and pure CO_2 gas**. Compared to barrier tubing, vinyl product line is relatively permeable to oxygen ingress, and the flavor of Kombucha stored in these lines can change overnight. As part of their opening procedures each day, some retailers will drain this Kombucha to ensure freshness.

As permanent installations, direct-draw systems typically include a drip tray, and some systems also incorporate a tap tower. In addition, shanks support the faucets in either tower or wall-mount applications. The following sections discuss these elements of the system.

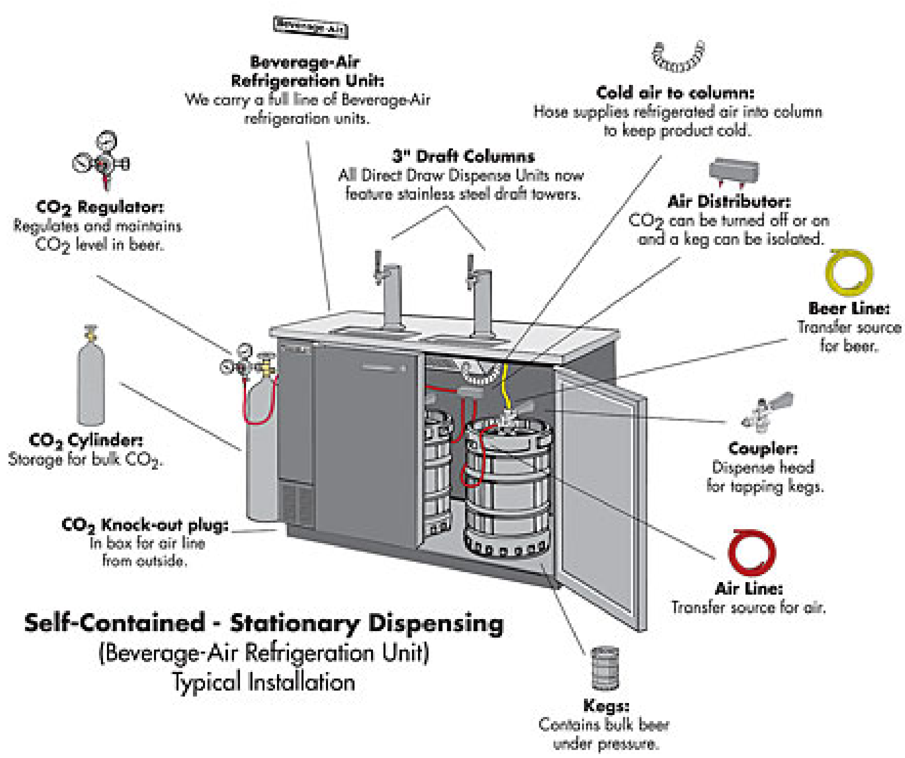


Image from Micro Matic

Drip Tray

Many draught systems include a drip tray placed below the faucets and most health departments require them. Many walk-in based direct-draw systems use a **wall mounted drip tray that includes a backsplash.**

This design may be used on some air-cooled long-draw systems as well. Bars typically place surface or recessed drip trays under draught towers. The drip trays should be plumbed to empty into a drain or floor sink.

Towers

Direct-draw keg boxes and most long-draw systems mount the dispensing faucet on a tower. This tower attaches to the top of the bar or keg box. Towers come in various shapes and sizes and may have anywhere from one to dozens of faucets.

To achieve proper Kombucha service, **the product line running through the tower to the faucet must be kept at the same temperature as the Kombucha cooler**.

Direct-draw systems use air cooling, while long-draw systems typically use glycol cooling. The air-cooled towers are insulated on the inside and cold air from the cooler circulates around the product lines and shanks. This works with direct-draw systems due to the close proximity of the tower to the cold box. Some keg boxes have specialized corrugated tubing connected to the refrigerator's evaporator housing. This tubing is designed to be inserted in the tower to provide for cold air flow up to the faucet. Typically cold air is supplied directly from the discharge of the evaporator and is colder than the keg temperature.

Gas Leak Detectors

Gas leaks in a draft system can not only cost money in lost gas, but can also potentially cause pressure drops that can lead to foamy Kombucha. In enclosed spaces, large CO_2 leaks can be extremely dangerous or even deadly. Gas leak detectors are available that are plumbed directly into the gas supply line to the draft system. When no Kombucha is being poured, a float inside the device will rise if gas is leaking.


Electronic CO_2 monitors are also available for installation in walk-in coolers. Such devices can prevent serious injury or death from CO_2 inhalation by sounding an alarm when CO_2 levels are elevated.

Beverage grade CO_2 comes from many commercial and industrial operations and is supplied for many uses besides beverages (e.g., fire extinguishers, welding, food processing, etc.). CO_2 bottles can be contaminated by poor handling and storage. They can be contaminated by Kombucha or soft drinks if a check valve malfunctions and the Kombucha or soft drink flows back into an empty CO_2 bottle.

A gas filter helps safeguard Kombucha by removing unwanted impurities or contaminants from the gas. Filters must be replaced periodically per the manufacturer’s instructions.

Carbonation Dynamics

The level of carbonation in Kombucha responds to changes in storage and serving conditions. EXAMPLE: an average keg of Kombucha with a carbonation of 2.5 volumes of CO_2

Kombucha temperature and the CO_2 pressure applied to the keg influence the amount of CO_2 dissolved in any keg of Kombucha. At any given temperature, a specific pressure must be applied to a keg to maintain the carbonation established by the brewery. If temperature or pressure varies, carbonation levels will change.

Kombucha in a keg at 38°F needs a pressure of 11 psi to maintain 2.5 volumes of CO_2 as the Kombucha is served. As long as the temperature and pressure remain constant, the Kombucha maintains the same carbonation level.

Temp	CO_2 pressure: 9 psi	11 psi	**13 psi**
34 °F	2.5	2.7	2.9
38 °F	2.3	2.5*	**2.7**
42 °F	2.1	2.3	2.5

Temp	CO_2 pressure: 9 psi	**11 psi**	13 psi
34 °F	2.5	2.7	2.9
38 °F	2.3	**2.5***	2.7
42 °F	2.1	2.3	2.5

* Pressures rounded for purposes of illustration. Do not use these charts for system adjustment.

Temp	CO_2 pressure: 9 psi	**11 psi**	13 psi
34 °F	2.5	2.7	2.9
38 °F	2.3	2.5*	2.7
42 °F	2.1	**2.3**	2.5

If the temperature of the Kombucha changes, so does the required internal keg pressure. In the chart to the right, if the pressure remains at 11 psi but the temperature of the Kombucha rises to 42°F, carbonation will begin to move from the Kombucha to the headspace. Over a few days, the overall carbonation in the Kombucha drops to 2.3 volumes of CO_2.

Alternately, if the temperature remains at 38°F, but the CO_2 pressure increases to 13 psi, then the carbonation level of the Kombucha in the keg will increase to 2.7 volumes as the Kombucha slowly absorbs additional CO_2.

The "ideal gauge pressure" for a Kombucha is the pressure at which CO_2 is not diffusing from Kombucha into the headspace and excess CO_2 is not absorbing in the Kombucha. This value varies from account to account depending upon factors such as temperature, altitude, and carbonation level of the Kombucha. **Because Kombucha carbonation can vary with the temperature of your cooler and the pressure applied to the keg, you must take care to maintain steady values suited to your system and Kombuchas.**

A Note about Altitude

Pressure gauges used on draft systems measure in pounds-per-square-inch gauge, or "psig". This is the difference between the pressure in the keg and atmospheric pressure (14.7 psi at sea level). When dispensing Kombucha at elevation, the carbonation level of the Kombucha does not change but the pressure displayed on the gauge will read low, by approximately 1 psi per every 2,000 feet. So a keg dispensed at 10,000 feet would need to have the gauge pressure increased by approximately 5 psig above the calculated dispense pressure at sea level.

Determining CO_2 pressure in a Direct-Draw System

Because direct-draw systems are typically quite short, the pressure of 100% CO_2 required to maintain proper carbonation is usually sufficient by itself to deliver the Kombucha from the keg to the faucet without over carbonating the Kombucha.

You can determine ideal gauge pressure for pure CO_2 from Appendix B. If you do not know the carbonation level in the Kombucha, you can estimate it using the procedure found in Appendix B.

System Balance and Achieving Flow

So far we have seen what happens to a Kombucha's *carbonation* in the keg as the result of *applied pressure* and *temperature.* Kombucha must travel from the keg to the glass, and along the way it encounters a fourth measure, *resistance.* The product line and changes in elevation impart resistance to the flow of Kombucha from the keg to the faucet.

The pressure applied to the keg overcomes this resistance and drives the Kombucha through the system and to the customer's glass. **To achieve proper flow and Kombucha quality, the pressure applied to the keg must equal the total resistance of the draft system.**

We have already demonstrated that the pressure applied to the keg needs to be matched to the carbonation level of the Kombucha. This creates a problem when the resistance of the system calls for more, or less, pressure than is needed to maintain the carbonation of the Kombucha. To prevent conflicts and balance the system, draft technicians design system resistance to match the pressure applied to the Kombucha.

A balanced draft system delivers clear-pouring Kombucha at the rate of 2 ounces per second. This means it takes about eight seconds to fill a pint glass, thirty seconds for a growler and about one minute to pour 1 gallon of Kombucha.

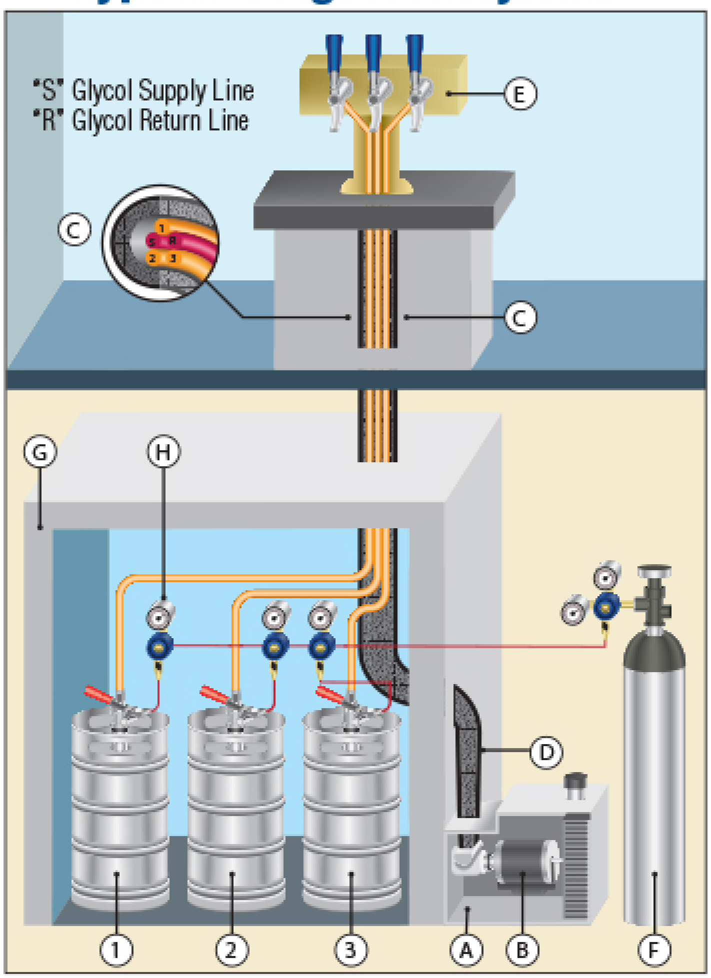
For most direct-draw systems, balancing the system is quite simple. Most direct draw kegerators and walk-in coolers where the kegs are close to the faucets will simply take a 4-5 foot length of 3/8" ID vinyl tubing.

Some system setups benefit from flow rates faster or slower than 1 gallon per minute. If you try to achieve faster pours by increasing the gas pressure, you will create over carbonated Kombucha and foam at the tap. Foamy Kombucha can also be the result if you achieve slower pours by decreasing pressure. This can also create flat Kombucha. If you need to change flow rate, the resistance of the system should be altered to achieve this result, not the gas pressure. **Gas pressure, once set for a particular Kombucha, remains constant and should never be adjusted to alter the flow rate of the Kombucha.**

For long-draw systems or systems that need different flow rates, figuring restriction and choosing the correct tubing is more complex. For more information on these calculations, see page 53.

Chapter 4: Equipment and Configurations for Long-Draw Draft Systems

Typical Long Draw System



A. Glycol Cooling Unit
B. Glycol Pump
C. Insulated Trunk Lines
D. Insulated Glycol Lines
E. Draft Tower
F. CO_2 Cylinder
G. Walk-In Cooler
H. In-Line Regulator

The most complex draft systems fall into the long-draw category. Designed to deliver Kombucha to bars well away from the keg cooler, these systems usually employ equipment not seen in temporary and direct-draw setups. Today it is common to find very complex draft systems at retail with dozens of faucets.

Image from Rapids Wholesale

While long-draw systems offer designers the option to put Kombucha far from the bar, providing keg handling or layout flexibility, the distances they cover come with increased opportunities for problems and increased costs for equipment, cooling, and Kombucha waste. As with all systems, it is important to minimize line length and diameter where possible to minimize Kombucha loss and facilitate cleaning.

Let us consider the three draft dispense sub-systems of Kombucha, gas, and cooling to see what long-draw systems include.

Kombucha

While exceptions exist, most long-draw systems still push Kombucha from kegs. Kombucha exits the keg through a coupler and usually enters a vinyl product line just as we have seen with temporary and direct-draw systems. But here the vinyl does not last long. It typically goes about six feet before connecting to a wall bracket that serves as a transition to specialized barrier tubing.

Designed for minimum resistance and superior cleanliness, barrier tubing should carry Kombucha most of the distance from keg to faucet in long-draw systems. But barrier tubing is not the end of the journey; most draft towers use stainless steel tubing to carry the Kombucha to the faucet. In addition, many systems include some length of narrow-gauge vinyl tubing called "choker" between the end of the barrier tubing and the stainless steel tubing of the draft tower, to provide a way to accurately balance the system. In the end, however, the Kombucha flows through a faucet just as we saw with the direct-draw systems.

You may also find Foam on Beer (FOB) detectors on the product lines of many long-draw systems. Located in the cooler at or near the wall bracket, these devices fill with dispense gas when Kombucha from a keg runs out, thereby shutting off flow to the main product line. This prevents Kombucha loss by keeping the main product line full of pressurized Kombucha while the keg is changed. The jumper line between the keg and FOB is then purged and normal Kombucha service can resume.

Image from Micro Matic - Foam on Beer detectors

Components

Barrier Tubing

Barrier tubing has a "glass-smooth" lining that inhibits microbial growth to maintain Kombucha freshness. Its properties make it the only industry-approved product line for long-draw systems. Barrier tubing may be purchased separately in various diameters, but most suppliers sell it in prepared bundles (called bundle or trunk housing) with product lines and glycol coolant lines wrapped inside an insulating cover. These bundles vary by the number of product lines they carry with popular sizes matching the number of faucets commonly found on tap towers.

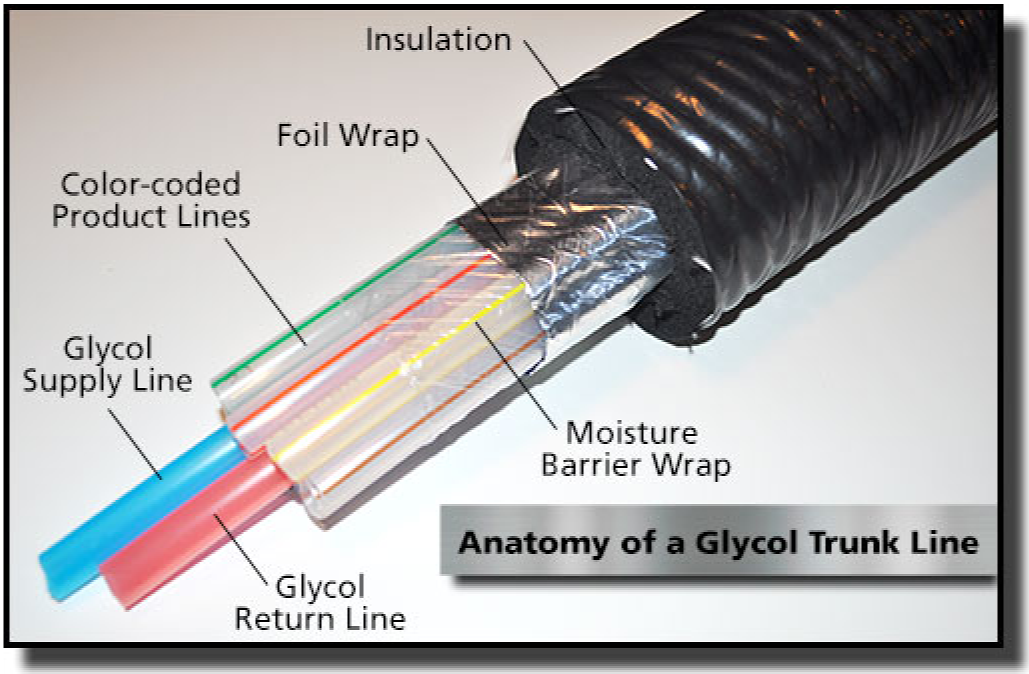


Image from CleanBeerTechnology.com

Many older long-draw systems installed single-wall polyethylene tubing. This relatively porous material allows oxygen ingress, carbon dioxide to escape, and makes cleaning difficult, resulting in stale, flat, and potentially tainted Kombucha in the lines. Today, you may find blue and red polyethylene tubing carrying glycol from and to your glycol power pack; this is the only recommended use for polyethylene tubing in long-draw systems.

Long-draw systems with vinyl or polyethylene lines (typical of much older systems) should be repacked with fresh Kombucha each day due to the detrimental effects of oxidation. This expense alone can significantly decrease the payback time when replacing an old long-draw system with barrier tubing. These systems are not commonly found as most have been replaced with barrier tubing systems.

Vinyl tubing should only be used as jumpers between keg couplers and long-draw barrier tubing trunks, and as restriction tubing between barrier tubing trunks and faucet shanks. Vinyl and polyethylene tubing should never be used in long-draw bundles.

Wall Brackets

Wall brackets join tubing together in a long-draw cold box. The wall bracket gives a solid connecting spot for jumper lines from the keg. Tubing is connected with a washer, nut, tailpiece, and clamp combination. (Most of these installed in the past were made of plated brass, and should be inspected for wear and replaced with stainless steel.)

Choker Line

Choker line, also known as restriction tubing, is a section of 3/16” ID vinyl tubing of variable length installed at the tower end of a long-draw system. The purpose is to add to the overall system restriction and thus achieve the target flow rate at the faucet. It is connected at one end to the barrier tubing in the trunk housing with a reducing splicer, and at the other to a hose barb on either the back side of the shank inside the tower, or to the stainless tubing extending from the tower.

Using vinyl line to provide restriction is problematic, however, in that over time, because of its porous nature, it will become difficult to keep clean. It should be changed periodically, but this is not always practical in a sealed tower. Less porous 3/16” tubing materials for choker are available.

A few different specially designed devices can be used as alternatives to constructing final choker restriction with long lengths of 3/16” ID polyvinyl hose. One such device is a series of plastic segments that are inserted into a short section of 1/4” ID barrier tubing just below the tower; another is a wire mesh device installed in the shank just behind the faucet. These devices are of varying restriction and, while potentially useful, also have some potential downsides. For one, these items prevent product line cleaning with sponges as an option.

Kombucha Pump (Beer Pump)

Beer pumps draw Kombucha from a keg or other Kombucha-serving vessel and deliver it to the faucet. Kombucha pumps should be made from food grade plastic with stainless steel components. Confirm with your supplier.

Rather than using gas pressure to drive Kombucha, Kombucha pumps use mechanical force to propel the Kombucha through the system. Kombucha pumps are usually found in draft systems when working pressures for gas dispense get too high (above 35 or 40 psi). This includes very long runs (>200 feet) or high vertical lifts (ex. going from a basement to a main floor). Above these pressures, Kombucha will absorb enough nitrogen from the blended dispense gas to create long- lasting, smaller-sized foam bubbles that in turn can cause problems dispensing Kombucha. Kombucha pumps are often used on multi-barrel brewpub serving tanks that have low-pressure limits. Serving tanks must be constructed to American Society of Mechanical Engineers (ASME) standards in order to safely dispense Kombucha above 15 psi.

Kombucha pumps themselves are powered by high-pressure gas or compressed air that does not come into contact with the Kombucha. Most retailers power their Kombucha pumps with CO_2; in these cases, **the pump exhaust CO_2 gas must be vented outside the cooler or building to avoid CO_2 buildup and asphyxiation.** CO_2 can be relatively expensive to use to power Kombucha pumps compared to compressed air, but CO_2 is usually already available at any location serving draft Kombucha, so is often simpler to use.

If using compressed air to drive Kombucha pumps, pump and keg regulators must be separated—compressed air should never come into contact with draft Kombucha. Also, high quality air compressors that clean and dry the air must be used to avoid damaging Kombucha pumps; smaller, less expensive air compressors can deliver air with small amounts of moisture or oil that can damage Kombucha pumps over time. Air compressors also can break down, leaving the retailer unable to dispense Kombucha.

Some portion of the pump contacts the Kombucha and, like anything else, it must be regularly cleaned to prevent Kombucha buildup and microbial infection. See special cleaning considerations on page 54 of this manual.

Kombucha pump setups require two operational pressures:

1. CO_2 pressure on the keg or tank to maintain Kombucha carbonation
2. Separate gas pressure to the pump to propel the Kombucha to the faucet

There are two basic Kombucha pump types:

1. Additive pressure
    a. Most useful for very long draw systems.
    b. The pressure applied to the keg is added to the pressure of the gas driving the Kombucha pump.
    c. Additive pressure pumps have one other advantage—Kombucha may still be dispensed (although much more slowly) if they fail.
    d. Set pump pressure so that the sum total of the keg pressure plus pump pressure together equal system resistance pressure.
2. Fixed pressure
    a. Much less common today.
    b. Fixed pressure pumps deliver Kombucha at the same pressure being applied to the Kombucha keg or tank,which means they are less useful in systems balanced at higher pressures.
    c. Kombucha cannot be served if a fixed pressure pump fails.

Here are some good rules of thumb for using beer pumps in draft Kombucha dispensing systems:

- Refer to detailed cleaning procedures provided by the pump manufacturer, and procedures found on page 54 of this manual.
- Cleaning solution that is too hot will damage the pump.
- Only use beer pumps that come fitted with a diverter or backflush fitting
    - This way the pump can be properly cleaned using recirculation pumps, in either forward or backward direction.
    - One such pump fitted with a flow diverter is shown on the previous page.
- Proper CO_2 pressure (ideal gauge pressure) should be applied to the keg or tank to maintain the Kombucha’s carbonation level (See Appendix B).
- Most draft Kombucha systems with beer pumps also use FOBs placed immediately after the to prevent it from running dry when the Kombucha supply runs out
    - Dry pumping is a primary cause of pump failure.
- Vent CO_2 out of the cooler for the pump exhaust.

- Limit two faucets per beer pump.
- Don’t run more than two beer pumps per secondary regulator.
- For pumps to function properly, they should be located close to the source (the keg).

Special fittings can join the different types of product line found in long-draw systems. Quick-connect fittings work on hard or rigid tubing including polyethylene (used for glycol), barrier line, and stainless tubing. Couplers attach to square-cut tubing ends with an “O” ring and gripper. Adding a vinyl adapter to the coupler allows for transition from barrier or stainless to vinyl tubing.

Mixed Gas - Carbon Dioxide

(CO_2 and Nitrogen N_2)

Pushing Kombucha across the distances found in long-draw systems usually calls for gas pressures well above what is needed to maintain proper Kombucha carbonation levels with 100% CO_2. Kombucha readily absorbs carbon dioxide, so any change in CO_2 pressure results in a change in the carbonation of the Kombucha.

Nitrogen is different. For one, it does not absorb into Kombucha at typical system operating pressures. Also, as an inert gas, it does not degrade the flavor of the Kombucha. These qualities make it perfect for blending with CO_2 to achieve higher pressures without over carbonating the Kombucha. Thus, in high resistance draft systems, we use a mixture of CO_2 and N_2 to achieve two objectives:

1. Maintain proper Kombucha carbonation.
2. Overcome the system resistance to achieve a proper pour.

The exact mix of CO_2 and nitrogen depends on all the factors discussed:

- Kombucha temperature and carbonation
- System resistance
- Total applied pressure that’s required

The details of these calculations are shown in Appendix C. There are also some excellent resources online, including easy-to-use calculators to help determine the exact custom blend needed for your draft Kombucha system. (https://mcdantim.com/beverage/tools/calculator)

The correct blend might be purchased pre-mixed in blended gas bottles, or custom blends can be mixed onsite from separate carbon dioxide and nitrogen sources. The use of custom gas blends brings new equipment into play, including gas blenders and possibly nitrogen generators.

Blended Gas Bottles

Blended gas bottles are gas vendor-mixed CO_2 and nitrogen gas mixes. They are not commonly used in the Kombucha industry due to their higher expense and lower volume of CO_2. Often called “G-Mix” or “Guinness Gas,” these blends are typically available in blends of 30-25% CO_2 / 70-75% N_2 and are designed for use with nitrogenized or “nitro” Kombuchas. Although their use is commonplace in other applications, there are several limitations to this mixed gas source. The physical characteristics of CO_2 limit the amount of blended gas that can be stored in a blended gas bottle, compared to pure CO_2 or N_2. CO_2 becomes liquid at the very high pressures needed to compress nitrogen, meaning the blended gas being dispensed from the headspace of the bottle will not be the blend proportion anticipated if the bottle is overfilled. For this reason, blended gas bottles contain a very low volume of gas and are thus relatively expensive compared to other mixed gas sources such as gas blenders. When comparing the cost of a gas blender to the ongoing expense of premixed cylinder gas, the payback period for the blender is often under a year.

Also, the higher percentage of CO_2 that goes into the blend, the lower the overall volume that can go into the cylinder before the CO_2 becomes liquid. This limits most of the blends in pre-mixed cylinders to very low CO_2, or "nitro" applications, and if a high-percentage CO_2 blend is made available in a pre-mixed cylinder, the overall volume will be extremely low.

Additionally, the tolerances of bottled blended gas are very difficult to manage during filling. Unless the bottled blend is well mixed, the bottle can become over-pressurized and the CO_2 can become a liquid, causing the gas being dispensed to vary considerably from the desired mixture. This deviation can result in over- or under-carbonated Kombucha, therefore increasing expense and decreasing draft Kombucha quality.

Single Mix Blender

Two Mix Blender

Three Mix B lender

Pre-mixed cylinders containing a mix of between 30-25% CO_2 and 70-75% N_2 are only intended for use with nitrogen-infused Kombuchas or "nitro" Kombuchas. These blends are not intended for use with regularly carbonated Kombuchas (those with more than 2.0 volumes or 3.9 grams/liter of CO_2), even in high-pressure long-draw systems. Use of "nitro" Kombucha gas on regularly carbonated Kombuchas causes these Kombuchas to lose carbonation in the keg or serving tank. This results in flat Kombucha being served within three to five days. This flat Kombucha is most noticeable near the end of the keg, with the amount of flat Kombucha increasing the longer the Kombucha is in contact with this gas. Similarly, straight CO_2 should not be used to dispense nitro Kombuchas, as they will over carbonate very quickly and become un-pourable.

Gas Blenders

Gas blenders provide the most flexibility in obtaining mixed gas for draft dispense. They mix pure CO_2 and pure nitrogen from individual tanks in specific ratios and can provide one, two, or even three blends on a single panel.

Single product blenders will typically contain a CO_2-rich blend designed for regularly carbonated Kombuchas. For simplicity, many installers would put in a blender with little thought or planning as to what the blend is, simply deferring to what was the commonly stocked 60% CO_2/40% N_2 blend.

Recent studies from the beer industry in retail establishments have shown that a 70% CO_2/30% N_2 blend will more likely result in proper carbonation of draft Kombucha in most retail draft Kombucha systems. This has led the industry to stock the 70% CO_2/30% N_2 blend as the default blend for installers who do not specify a specific blend. This is not necessarily the best blend for every situation, however.

The best approach for high quality draft Kombucha is to identify and use the exact correct gas blend for your particular draft Kombucha system. See Appendix C of this manual for examples of this calculation, or consult your professional draft Kombucha equipment installer or supplier for more advice.

Double product blenders usually have one CO_2-rich blend for regularly carbonated Kombuchas with the second blend being a 25% CO_2 / 75% N_2 blend for "nitro" Kombuchas.

Triple product blenders will have two different CO_2-rich blends calculated to adequately serve Kombuchas with a reasonable range of CO_2 volumes (e.g. 2.0-2.8 volumes of CO_2), with the third blend being the 25% CO_2 / 75% N_2 blend for "nitro" Kombuchas.

Existing one and two mix blenders can sometimes be upgraded to two and three blends; check with your supplier. Recommended features for a gas blender include:

- Output mix is preset by the manufacturer and is not adjustable onsite.
- Blender shuts down when either gas supply runs out, preventing damage from running on only one gas

Nitrogen Generators

Nitrogen generators extract nitrogen from the atmosphere. Air is supplied by either a remote or integrated air compressor. Nitrogen generators are typically equipped with a built-in gas blender.

To protect nitrogen purity from compromising draft Kombucha quality, nitrogen generators should have the following features:

- Produce nitrogen with a purity of at least 99.7%.
- Equip air inlets with both an oil/water filter and a sterile air filter.
- Use "oil-free"-type air compressors.

All nitrogen generator filters should be inspected and replaced according to the manufacturer's specifications.

System Balance and Achieving Flow

Having identified our type of dispense gas, and then calculated our gas blend and applied pressure with the formulas in Appendix C, we can now balance the elements of the draft system to achieve our desired flow rate. Our goal is to identify and add up all of the elements in the system that contribute to system resistance and get that figure to match the applied pressure in psi.

Remember that we want to know the temperature of the actual Kombucha. Since it takes a keg of Kombucha many hours to stabilize at the temperature of the cooler, the Kombucha temperature can vary quite a bit from the setting of the thermostat in your cooler.

We measure **applied pressure** in pounds per-square-inch-gauge abbreviated as "psig," or often just "psi." The pressure applied to any keg is shown by the gas regulator attached to it.

Resistance comes from changes in elevation and draft system components like the product line as the Kombucha flows from keg to glass. We measure resistance in pounds and account for two types: static and dynamic. For the purposes of this manual, and generally speaking in the trade, pounds of resistance are considered equivalent to pounds per square inch of pressure when balancing a draft Kombucha system.

Static resistance comes from the effect of gravity, which slows the flow of Kombucha being pushed to a level above the keg. Here's one way to think about static resistance: if you have a U-tube filled with water, you can blow in one side and push the liquid up the other side of the tube. The weight of the liquid pushes back with hydrostatic (or "still-liquid") pressure. Each foot of increased elevation adds 0.43 pounds of hydrostatic pressure to a draft Kombucha system that must be overcome by dispense gas pressure. A figure of 0.5 pounds is often used in the trade for ease of calculation and is used in this manual as well.

If the Kombucha travels to a faucet above keg level, each foot of increased height will add approximately 0.5 pounds of resistance to the system. If the Kombucha travels to a faucet below keg level, each foot of decreased elevation will subtract approximately 0.5 pounds of resistance from the system. The gravity factor remains the same regardless of tube length, bends, junctions, or other configuration issues. When the keg and faucet heads are at the same height, there is no static resistance and this factor has a value of zero.

In the past, the elevation difference used to determine static resistance was often measured from the base of the kegs being dispensed to the faucet height. Because a full keg will contain about 2 1/2 feet of Kombucha, we recommend measuring from the middle of the keg being dispensed to the faucet height. Likewise for large serving vessels: measure from the middle of the serving vessel fill height to the faucet height.

Dynamic resistance derives primarily from product line, and also from some of the many components in a draft Kombucha system (so-called "hardware resistance"). Items like couplers and faucets usually have negligible resistance values, although some might have a specified value. Faucet towers can range from 0 pounds to as high as 8 pounds of dynamic resistance; be sure to check with the manufacturer for exact tower resistance.

The combination of product line tubing may include the following: 1. the **jumper,** which is typically 5 or 6 feet of flexible vinyl tubing that runs from the keg coupler to the wall bracket; 2. the **trunk line,** which is the main section of tubing, usually barrier, that runs the length of the system from the wall bracket in the cooler to the tower; 3.the **choker,** which is a small diameter tubing, usually 3/16" vinyl, that connects the trunk line to the stainless steel tubing or sometimes the back of the shank inside the tower. The choker is the biggest variable the installer uses to fine-tune system resistance to achieve balance. By varying the length of this high-resistance tubing, he or she can control flow rate to a large degree.

A few different specially designed devices can be used as alternatives to constructing final choker restriction with 3/16” vinyl tubing. One such device consists of a series of plastic segments inserted into a short section of 1/4” ID barrier tubing just below the tower. Another is a wire mesh device installed in the shank just behind the faucet. These devices are of varying restriction and, while potentially useful, also have some potential downsides. For one, these items prevent product line cleaning with sponges as an option. Additionally, the increased surface area may increase the likelihood of Kombucha buildup or foaming.

These three components that contribute to dynamic resistance all have different resistance values. This is due to:

1. the tubing material
2. the tubing diameter
3. the tubing length

Different resistance values per foot are shown in the chart below for commonly used materials and diameters. (Note: This chart is provided as an example only. Please consult your equipment manufacturer for exact values for your specific product lines and system components.)

Once the resistance values are obtained for the three main elements of dynamic resistance, plus any other significant parts (tower, etc.), that total dynamic resistance value is added to the value for the static resistance in the system. This number is our **total system resistance.** When total system resistance (in pounds) is equal to the applied pressure (in psi) our flow rate will be 1 gallon per minute.

BEER TUBING			
Type	**Size**	**Restriction**	**Volume**
Vinyl	3/16” ID	3.00 lbs/ft	⅙ oz/ft
Vinyl	1/4” ID	0.85 lbs/ft	⅓ oz/ft
Vinyl	5/16” ID	0.40 lbs/ft	½ oz/ft
Vinyl	3/8” ID	0.20 lbs/ft	¾ oz/ft
Vinyl	1/2” ID	0.025 lbs/ft	1-⅓ oz/ft
Barrier	1/4” ID	0.30 lbs/ft	⅓ oz/ft
Barrier	5/16” ID	0.10 lbs/ft	½ oz/ft
Barrier	3/8” ID	0.06 lbs/ft	¾ oz/ft
Stainless	1/4” OD	1.20 lbs/ft	⅙ oz/ft
Stainless	5/16” OD	0.30 lbs/ft	⅓ oz/ft
Stainless	3/8” OD	0.12 lbs/ft	½ oz/ft

Designing For Resistance

While the individual components in any draft system have a fixed resistance value, draft system designers select from a variety of choices to create systems with a target total resistance value. For instance, a 20-ft. run of 1/4" internal diameter vinyl product line gives a total resistance of 17 psi while 5/16" barrier tubing of the same length only generates 2 pounds of resistance. If our target resistance value is 20 psi, the 1/4" vinyl system would need 1 foot of 3/16" choker line added at the tower end to achieve the total system target resistance, whereas the 5/16" barrier system would need 6 feet of 3/16" choker added at the tower end to reach the same target (see chart above).

Whenever possible, it is desirable to design the system so as to minimize, if not eliminate, the need for vinyl choker line at the tower end. This tubing is usually wrapped into a permanent installation where the recommended yearly change-out of vinyl tubing is not feasible.

Accommodating Kombuchas with varying CO_2 volumes

A common issue that arises with draft system design is how to deal with Kombuchas with varying volumes of carbonation that are being poured on the same system. The typical system stores all the Kombucha at one temperature and pours them all with the same gas blend at the same operating pressure through draft lines that all have the same restriction value. The net result is that some Kombuchas may lose carbonation while other Kombuchas will gain carbonation in the same system. This one-size-fits-all setup is not ideal. In order to accommodate for these differences, we can make certain changes with the system equipment and setup parameters.

CO_2 Percentage Adjustment

The adjustment of CO_2 percentages for different Kombuchas has historically been difficult, if not impossible. Gas blending panels usually have only one CO_2-rich blend available, with dual blend panels typically accommodating nitrogenized Kombuchas with the second blend.

Gas blending panels are now available that offer three blends: the nitro Kombucha blend and two different CO_2-rich blends for regularly carbonated Kombuchas. As it turns out, most regularly carbonated Kombuchas can be divided into two general groups of carbonation levels. The higher percentage CO_2 blend can balance the higher carbonated Kombuchas. These new panels allow the installer to customize a gas blend for each of these two ranges by following the chart below:

2.5 v/v Median		
Pressure	Storage Temp. 35-37°F	Storage Temp. 38-40°F
16-20 psi	75% - 80%	80% - 85%
20-25 psi	65%	70%

2.7 v/v Median		
Pressure	Storage Temp. 35-37°F	Storage Temp. 38-40°F
16-20 psi	80% - 85%	80% - 90%
20-25 psi	70%	75%

		psi at 60% CO_2				psi at 65% CO_2				psi at 70% CO_2	
		2.5 v/v	2.7 v/v			2.5 v/v	2.7 v/v			2.5 v/v	2.7 v/v
temp	40	27-33		temp	40	24-30	27-33	temp	40	21-26	24-29
°F	38	25-31	29-35	°F	38	22-28	26-31	°F	38	20-25	23-28
	37	25-30	28-34		37	22-27	25-30		37	19-24	22-27
	35	23-28	26-32		35	20-25	23-28		35	18-22	20-25

		psi at 75% CO_2				psi at 80% CO_2				psi at 85% CO_2	
		2.5 v/v	2.7 v/v			2.5 v/v	2.7 v/v			2.5 v/v	2.7 v/v
temp	40	19-24	22-25	temp	40	17-21	19-24	temp	40	15-19	17-22
°F	38	17-22	20-25	°F	38	15-20	18-22	°F	38	14-18	16-20
	37	17-21	20-24		37	15-19	17-21		37	13-17	16-19
	35	16-20	18-22		35	14-18	16-20		35	12-16	14-18

*Add 1 psi for every 2,000 feet of elevation to account for differences in atmospheric pressure.

Any draft system can be designed to operate under a range of applied pressure values. Whenever possible, the operating pressure will be set to maintain the carbonation of the Kombucha being served. Unfortunately, in some systems this doesn't work. Consider the resistance created by long product lines and climbs of two or more floors. Even with the lowest resistance components, the applied pressures for these systems often exceed that needed to maintain Kombucha carbonation. These systems must use mixed gas or pneumatic Kombucha pumps to overcome the problem.

*Add 1 psi for every 2,000 feet of elevation to account for differences in atmospheric pressure.

Applied Pressure Adjustment

Installers may choose to use a single gas blend for regularly carbonated Kombuchas and adjust the applied pressures on individual kegs to maintain proper carbonation. This is a helpful option in existing systems with a single CO_2-rich gas blend or when a multi-blend gas blender is not available for use. When regularly carbonated Kombuchas are divided into two different groups, depending on their carbonation level, appropriate pressures for individual Kombuchas can be determined from the chart above.

Most systems have all lines restricted equally, so applying different pressures to different Kombuchas will result in certain Kombuchas flowing faster or slower than others in the same system. These flow rate variances are normally not an issue and still allow for nearly optimal flow rates of 2 ounces per second, as long as the pressure variance between different Kombuchas is kept at or below 5 psi.

Applied Pressure Adjustment with Flow Control Faucets

In some instances, a Kombucha's carbonation level can be so high that this limited pressure adjustment range still does not allow the Kombucha to be poured. For these highly carbonated Kombuchas, the use of a flow-control faucet can be very helpful.

A flow-control faucet has a restriction lever on the faucet itself that allows the bartender to adjust the restriction of the system and the flow rate of the Kombucha at the point of dispense. This allows the pressure to be significantly increased to keep a highly carbonated Kombucha's carbonation level constant while still maintaining a manageable flow rate. Oftentimes this flow rate needs to be set much lower than 1 gallon/minute, as even this standard flow rate can cause very highly carbonated Kombuchas to foam in the glass.

The use of flow control faucets can be very helpful in all types of systems, including direct-draw systems using 100% CO_2. Some systems are outfitted with multiple gas blends inside the cooler and quick-disconnect fittings on individual gas lines. These setups allow the gas blend to be changed to a particular keg, depending on the carbonation level and the pressure/gas blend combination needed to balance the Kombucha's carbonation.

Balancing Draft Systems

Having reviewed all the concepts behind draft system balance, let's examine two example systems to see how these variables are adjusted to create balanced draft systems in several different settings.

This example assumes that the dispense gas blend mixture is already fixed; a vertical lift of 12 feet; and a Kombucha trunk line total run of 120 feet. Find the operating pressure of the system, and then determine appropriate tubing size for the trunks, and length of restriction tubing.

Kombucha Conditions

- Kombucha temperature: 35°F/1.67°C
- Kombucha carbonation: 2.6 volumes of CO_2 per volume of Kombucha

Dispense gas: 70% CO_2 / 30% N_2 blend

- From Appendix C:
    - a = ((b+14.7)/c) – 14.7

    - where ‘a’ is the pressure, ‘b’ is the ideal pressure of straight CO_2 for this situation (in this case, 10.7 psi, see chart in Appendix B), ‘c’ is the proportion of CO_2 in the blended gas
    - a = ((10.7+14.7)/0.70) – 14.7
    - a = (25.4/0.70) – 14.7
    - a = 36.3 – 14.7
    - a = 21.6, or round to 22 psi
- Gas pressure needed to maintain carbonation = 22 psig

Static Pressure

- Vertical lift = 12 feet (Tap 12 feet above the center of the keg)
- Static resistance from gravity = 12 ft. x 0.5 pounds/foot = 6.0 pounds

Balance

- Applied dispense gas pressure of 22 psi must be balanced by total system resistance
- Since static resistance equals 6 pounds, the system will need a total of 16 pounds of dynamic resistance

Restriction = 22 - 6 = 16 pounds

- 120 ft. of 5/16” barrier @ 0.1 pounds per foot = 12 pounds
- 1.3 ft. 3/16” vinyl choker = 4 pounds
- 12 + 4 = 16 pounds

Cooling

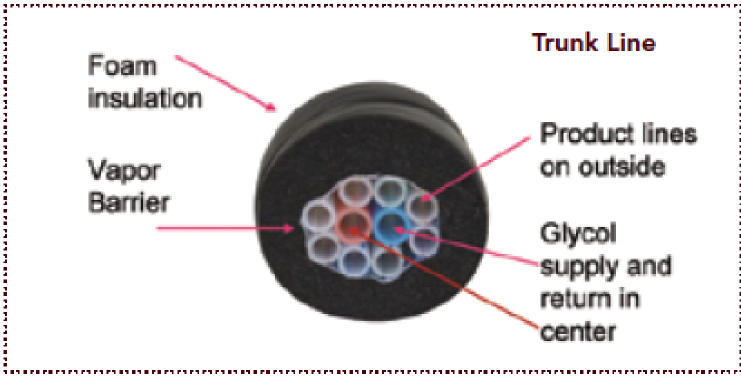
As with direct-draw systems, kegs reside in a walk-in cooler held at 34° to 38°F (1.11 - 3.33°C). But to keep Kombucha cold throughout its journey from keg to faucet requires refrigeration back to the cooler. Single-duct systems use a tube-in-tube design effective for runs of up to 15 feet.

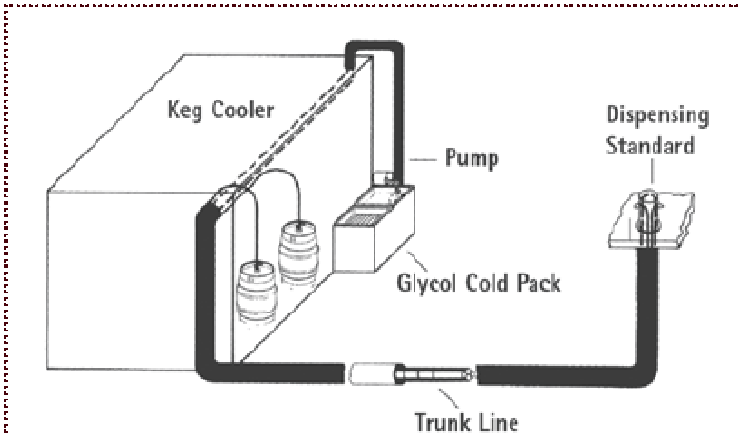
Runs of up to 25 feet can be created using double-duct systems where separate tubes carry the outbound and return flows. These systems can be especially vulnerable to temperature fluctuations in the outside environment. All ductwork should be well insulated.

Careful assessment of the room temperature should be taken into consideration before installation. It is important to note that temperatures near the ceiling of an already hot basement or storage room where the ducts may run can be significantly higher than at ground level.

It is also important to consider the extra cooling load placed on the keg cooler with such an installation. Many coolers are specifically designed to cool the exact dimensions of the cold box, and adding a forced-air system may overload and compromise the entire cooling system.

There are additional cooling components that surround the product lines themselves. We find two common designs: air-cooled and glycol-cooled.





Typical Long-Draw Glycol System

In a **forced-air long-draw system,** product lines travel through a tube or chase kept cold by a continuously operating recirculation fan. The fan pushes cold air from a condensing unit inside the cooler into and through the ductwork. In both single-duct and double-duct systems, cold air travels a route from the cooler to and through the tap tower as well as a return route

Glycol-cooled long-draw systems service runs longer than 25 feet. Here, a separate chiller pumps a chilled mixture of water and food-grade liquid propylene glycol through cooling lines parallel to and in contact with the product lines. These systems require well-insulated and carefully configured trunk line (see photo). Each product line (usually barrier line) in a trunk touches a glycol line to keep the Kombucha cold as it travels from keg to faucet. Glycol chillers work well as long as they are maintained.

Glycol towers attach coolant lines parallel to the product lines (typically stainless) and surround them tightly with insulation. This cooling method allows towers to be located remotely from the cold box, up to several hundred feet away.

In addition to the glycol chiller used to maintain temperature of the product lines, some systems, like those using frosted or "ice" towers, use a separate glycol cooling system to chill the tap tower.

Glycol Chiller Maintenance

Glycol chillers are key components to long-draw dispense systems. Chilled glycol helps to maintain the temperature of draft Kombucha in the product lines between the keg and the faucet. Glycol chillers are much less expensive to maintain than they are to replace; regular maintenance will increase both their service life and dependability. Here are some recommended maintenance practices; be sure to check with your manufacturer for items and procedures specific to your chillers.

- Glycol bath:
  - Keep cover of the glycol bath closed to prevent water vapor from diluting the strength of the glycol
- Check glycol bath temperature every two weeks
  - Confirm the bath temperature is within the range specified by the manufacturer
  - Many chillers have temperature gauges that are easily visible from the exterior
- Check pumps monthly
  - Check connections and insulation for leaks or missing insulation
  - Check for smooth-sounding operation
  - Confirm no signs of overheating
- Inspect condenser monthly for dirt and airflow obstructions
  - Clean as necessary
  - Remove and clean grills to expose the condenser fins
  - Remove all contaminants from the fin surface by using a stiff nylon bristle brush, vacuum cleaner, or compressed gas discharged from the fan side of the condenser.
  - Use caution as fins are delicate.
- Visually inspect trunk lines every six months for signs of
  - ice buildup
  - insulation damage
  - glycol leakage
- Glycol strength:
  - Check viscosity and condition of glycol-water cooling mixture every six months
  - Test freezing point every 18 months with a refractometer
    - adjust or replace glycol mixture as needed.
    - Typical ranges are 20-25% glycol
    - Confirm the glycol concentration follows manufacturer recommendations

Chapter 5: Preparation to Pour

While many of the issues relating to draft quality concern system settings and activities that occur at the bar, some operating issues require attention behind the scenes as well. In this chapter, we will present a checklist of system settings that will assist you in delivering great draft Kombucha to the consumer, including a keg temperature guide as well as other behind-the-scenes preparations that will affect draft performance. Finally, we will cover some guidelines for linking kegs in series.

Behind the Scenes Checklist

Before you can be sure your draft system will operate properly and consumers are served the best possible Kombucha, we recommend attention to the following items.

Outside the cooler

- ❏ Install/check confined space CO_2 detector for the area in order to stay safe and stay alive.
- ❏ Check glycol bath for operation temp in the 34° to 38°F (1.11° to 3.33°C) window.
- ❏ Visual check of dispense gas cylinders
    - ❏ Full CO2 = 800 psi
    - ❏ Full Nitrogen = 2,200 psi
- ❏ Bulk CO2 tank gauges operate on an "E" for empty and "F" for full scale
- ❏ Nitrogen generators operate on a pressurized gauge set to above 100 psi
- ❏ Product line cleaning log 180 days since last service
    - ❏ Check local ordinances concerning any required frequency

Inside the cooler

- ❏ Check cooler air temperature range = 36° to 38°F/ 2.22° to 3.33°C
- ❏ Check liquid temperature thermometer range = 36° to 38°F/ 2.22° to 3.33°C
- ❏ Check draft product lines are full of Kombucha and free of bubbles or kinks
- ❏ Confirm draft Kombucha on tap is within the brewer's freshness window to dispense
    - ❏ Varies by brewer
    - ❏ Kegs on tap for longer than 45 days may have changed compared to the intended flavor
- ❏ Confirm cooler is free of Kombucha leaks, drips or spills
- ❏ Check that all FOBs in the system are in the pouring position
- ❏ Check that all FOB drains are empty and free of buildup
- ❏ Visual check that all gas pressure gauges are operating in their ideal pressure setting
    - ❏ Straight CO_2 for most kombucha
        - ❏ 12 – 15 psi in direct-draw system
    - ❏ Blended CO_2 – Rich Blend (60 – 80% CO_2) for Kombucha
        - ❏ 22-25 psi in long-draw system. *Reference McDantim EasyBlend App.*
- ❏ Visual check that gas valves are in the open position
- ❏ Listen and feel around gas connections for leaks
    - ❏ Big leaks have a "hiss" sound.
    - ❏ Alternately, use a spray bottle with soapy water and spray the gas connections and look for bubbles forming which would indicate a leak

At the tower

- ❏ Flush the faucets with clean water and wipe dry with a clean microfiber towel
- ❏ Pour 1 oz to 3 oz. of Kombucha to be sure faucet works properly.
    - ❏ Evaluate to be sure the tap marker matches the Kombucha in the line
- ❏ Wipe down surfaces to be free of Kombucha spills.
- ❏ Check for fruit flies and other bugs living around the draft tower
    - ❏ Keep a fruit fly trap nearby to prevent flies from landing in product
- ❏ Check that glassware is free of any aromas, dust, lipstick or other imperfections

These routine checks will keep you and your staff in charge of the operating conditions in your draft system. You'll be proactive in the prevention of disruptions in service and delivery with your draft Kombucha system.

Cold Storage and Proper Chilling of Kegs before Serving

Chart 1	
Start Temp	**Time to 38℉**
50	25 hrs
48	23.5 hrs
46	21 hrs
44	18 hrs
40	7 hrs
38	0 hrs

To ensure fresh flavor and ease of dispense, draft Kombucha should remain at or slightly below 40°F/ 4°C throughout distribution, warehousing, and delivery. Brewers and distributors use refrigerated storage for draft Kombucha. In warm climates or long routes, they may also use insulating blankets or refrigerated delivery trucks to minimize temperature increases during shipping.

At retail, even a few degrees' increase above the ideal maximum of 40°F/ 4°C can create pouring problems, especially excessive foaming. Ideally all draft Kombucha delivered to retail will be stored cold until served.

Chart 2	
Time	**Temp**
0 hrs	38℉
1 hr	39℉
2 hrs	41℉
3 hrs	42℉
4 hrs	43℉
5 hrs	45℉
6 hrs	48℉

Recently arrived kegs should be allowed adequate chilling time as they usually warm to some degree during delivery. In order to avoid dispense problems, every keg must be at or below 40°F/ 4°C while being served. To help ensure that your kegs are properly chilled before serving, Chart 1 provides a guide to the approximate time needed to properly chill a keg to 38°F from a given starting temperature. Note that even kegs that "feel cold" (e.g., 44°F) may need to chill overnight in order to ensure proper dispense.

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Linking Kegs in Series

Busy accounts may connect kegs in a series or in a chain to meet peak capacity demands. Chaining two or three kegs of the same product together allows all of the chained kegs to be emptied before Kombucha stops flowing.

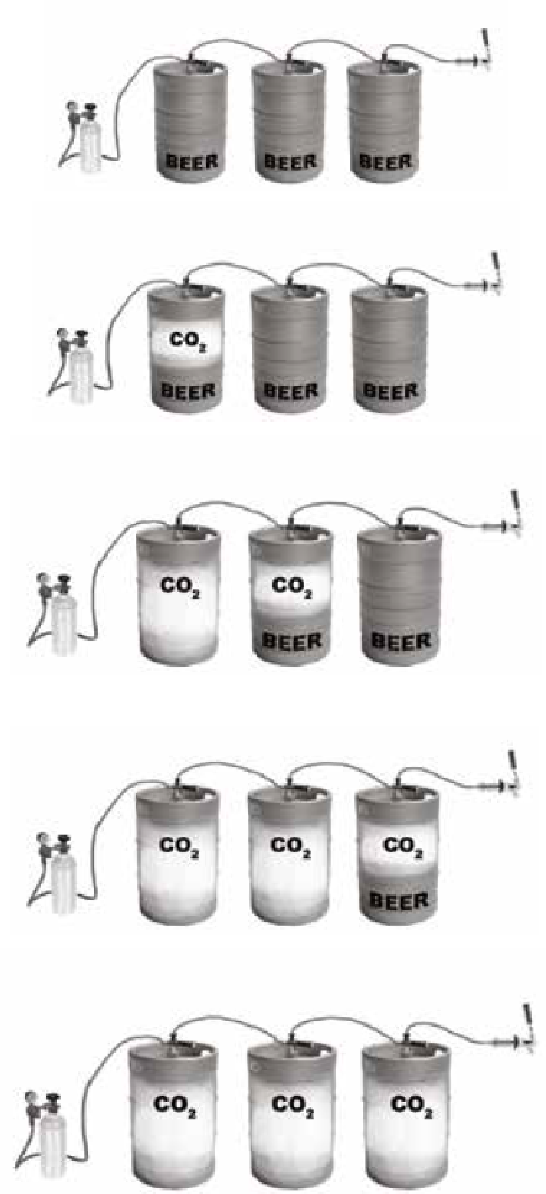
The first keg in the series will be tapped with a normal coupler. The second (and subsequent) kegs in the series require that the Thomas valve be removed from the gas side of the coupler.

Tap the first keg with the normal coupler. Instead of sending the product line from this first coupler to the bar faucet, connect it to the CO_2 inlet on the second keg's coupler. Subsequent kegs can be attached the same way.

When pressurized and pouring, Kombucha flows from the first keg to the second and on to the third before it travels to the faucet. Once set, this arrangement will pour the contents of all the chained kegs before it runs empty.

A series arrangement should only be used in accounts that will "turn" or empty kegs rapidly. The account needs to completely empty the entire series on a regular basis. Failure to empty the series completely leaves old Kombucha in the system.

Kegs linked in series



If a fresh keg is being rotated into a system that is not run dry, it is important to tap it in front of any empty or partial kegs in the system. **This prevents foaming from Kombucha entering a keg that is not already full.** The "Kegs Linked in Series" diagrams illustrate the progressive emptying of chained kegs.

Chapter 6: Serving Draft Kombucha

Properly designed and appropriately operated, your draft system will pour perfect draft Kombucha from its faucets. But the consumer's experience can still be ruined by improper pouring, residue in glassware, and unsanitary practices. In this chapter, we review the serving practices required to deliver high quality draft Kombucha.

To achieve the qualities the brewer intended, Kombucha must be served following specific conditions and techniques. Let's review some of the critical conditions necessary for proper draft dispense.

- Kombucha stored between 34°-38ºF/ 1º-3ºC
- Kombucha served between 38°-40ºF/ 3º-4ºC
  - To accomplish this, the glycol cooling the product lines in a long-draw system should be set to 34º - 36ºF/1º-2ºC
- Balanced draft settings (pressure = resistance)
- Normal flow rate of 2 ounces per second
- For Self Serve Kombucha Stations it may be better to have a flow rate of less than 2 ounces per second. This will compensate for the lack of general consumer knowledge of pouring properly.

Pouring Draft Kombucha

Proper serving of draft Kombucha is intended to have a "controlled" release of carbonation to give a better tasting and sensory experience. The evolution of CO_2 gas during pouring builds the foam head and releases desirable flavors and aromas.

Technique

1. Hold glass at a 45º angle, open faucet fully.
2. Gradually tilt glass upright once Kombucha has reached about the halfway point in the glass.
3. Pour Kombucha straight down into the glass, working the glass to form a one-inch collar of foam ("head"). This is for visual appeal as well as carbonation release.
4. Close faucet quickly to avoid wasteful overflow.

Pouring Hygiene

- <u>NEVER</u> allow the faucet nozzle to touch the inside of the glass.
  - Nozzles can cause glassware breakage
  - Nozzles can transfer contamination from dried Kombucha to glassware
- NEVER allow the faucet nozzle to become immersed in the consumer's Kombucha
  - Nozzles dipped in Kombucha are not considered sanitary

Free-Flow Pouring

- Kombucha pours best from a fully open faucet.
- To control the faucet during operation, hold the handle firmly at the base.
- Partially open faucets cause inefficiency and poor quality, namely:
    - Turbulent flow
    - Excessive foaming
    - Waste (inefficiency)

Pouring Growlers

Growlers are a great way to share the draft Kombucha experience. They are a modern-day, clean way to bring Kombucha home. Glass jugs with tight- sealing lids are used, those lids can be flip-top or screw-on. Growlers are typically about 1/2 gallon in volume and are filled off the faucet of your local establishment. This section will help guide you through a successful growler filling experience. It is important to note that the bottle should be rinsed immediately upon emptying to keep from infecting future refills.

1. For the best experience, rinse the growler out with cold water immediately before filling
    a. This helps to cool down the glass that could have been sitting in a warm car or out in the sun.
    b. This cooling process helps prevent excessive foaming during the fill.
2. Insert a tube into the faucet that reaches to the bottom of the bottle.
    a. 3/8″ i.d. x 1/2″ o.d. works perfectly for standard faucets.
3. The faucet handle is opened all the way and the growler fills from the bottom up.
    a. If the glass is cold enough, when foam starts to come out of the top, you can close the faucet, remove the tube from the growler, and seal.
4. Typically the growler will need to be rinsed off on the outside.
5. Seal the top with tape or heat-shrink seal.
6. Put a tag or label indicating what product is inside and you're good to go.
7. Rinse the filling tubes inside and out.
8. Dry tubes and place in cold storage.

Helpful hints

- Keep a container of sanitizer solution for the fill tubes in cold storage.
- Keep extra seals for either style cap behind the bar in case a customer brings in a different type of growler.
- Use brown bottles instead of clear glass. Brown glass will protect Kombucha from the harmful effects of light.

Faucet Hygiene

We recommend quickly rinsing faucets with fresh water at the close of business each day. Studies have indicated that retail locations that use this simple step, have faucets and product lines that are significantly cleaner. As an added benefit, the faucet won't become sticky as Kombucha dries out, so the first pour the next day will be much easier since the handle will move readily. Faucet plugs are available that insert in or cover the faucet opening when Kombucha is not being poured for extended periods. This may help to keep the faucet cleaner and more sanitary.

Chapter 7: System Maintenance and Cleaning

In addition to carbon dioxide, finished Kombucha contains trace amounts of ethanol, carbohydrates and hundreds of other organic compounds. The organisms in Kombucha can grow in draft lines especially those exposed to oxygen.

Within days of installing a brand new draft system, if not properly maintained, deposits may build up on the Kombucha contact surfaces. Without proper cleaning, these deposits can affect Kombucha flavor and undermine the system's ability to pour quality Kombucha.

When undertaken using proper solutions and procedures, line cleaning prevents the buildup of organic material while eliminating flavor-changing microbes. Thus, a well-designed and diligently executed maintenance plan ensures trouble-free draft system operation and fresh, flavorful Kombucha.

Cleaning Guidelines

Many states require regular draft line cleaning, but all too often the methods used fall short of what is needed to actually maintain draft quality. Please note that all parts of the recommendations must be implemented. The proper cleaning solution strength will not be effective if the temperature is too cool or there is insufficient contact time with the lines. The lines themselves will remain vulnerable to rapid decline if faucets and couplers are not hand-cleaned following the recommended procedures.

Retailers may or may not clean their own draft lines, but they do have a vested interest in making sure the cleaning is done properly. Clean lines make for quality draft Kombucha that looks good, tastes great, and pours without waste.

Take the time to review the guidelines in this manual and monitor your draft line cleaners—no matter who they are—to ensure that your system receives the service it needs to serve you and your customers well. Simple checks like maintaining cleaning logs, using a straw to scrape the inside of a faucet, and checking keg couplers for visible buildup will help to ensure your product lines are being properly maintained and serviced.

Common Issues

Later in this chapter, we cover the details of cleaning solutions and procedures, but first let's review some related issues. We start with an important look at safety, then briefly discuss design considerations and wrap up with the long-term maintenance issue of line replacement.

Cleaning Safety

Line cleaning involves working with hazardous chemicals. The following precautions should be taken:

- Cleaning personnel should be well trained in handling hazardous chemicals.

- Personal protection equipment including rubber gloves and eye protection should be used whenever handling line cleaning chemicals.
- Cleaning solution suppliers are required to provide Safety Data Sheets (SDS) on their products. Cleaning personnel should have these sheets and follow their procedures while handling line cleaning chemicals.
- When diluting chemical concentrate, **always add chemical to water** and never add water to the chemical. Adding water to concentrated caustic chemical can cause a rapid increase in temperature, possibly leading to violent and dangerous spattering or eruption of the chemical.

System Design and Cleanliness

Draft system designs should always **strive for the shortest possible draw length to help reduce operating challenges and line cleaning costs**. Foaming Kombucha and other pouring problems waste Kombucha in greater volumes as draw length increases. Line cleaning wastes Kombucha equal to the volume of the product lines themselves. Longer runs also place greater burdens on mechanical components, increasing repair and replacement costs.

New systems should be chemically cleaned and rinsed with cold water prior to pouring Kombucha. A system cleaning will help to eliminate potential contaminants and will remove oxygen from the lines. It is also recommended to purge all gas lines with CO_2 prior to tapping kegs to prevent oxygen from being pushed into fresh kegs.

One-way keg systems may require specific equipment to achieve desired cleaning methods. Split lines may also pose cleaning challenges. Check with the manufacturers of the various components in any draft Kombucha system to ensure that all components (line material, fittings, faucets, couplers, pneumatic pumps, fobs, etc.) are compatible with the cleaning methods and procedures you plan to use. The acceptable range of variables such as cleaning solution concentration, temperature, and pressure can vary by component and manufacturer.

Large venues like stadiums, arenas, and casinos often combine very long draft runs with long periods of system inactivity that further complicate cleaning and maintenance. Additional maintenance costs eventually outweigh any perceived benefits of a longer system.

Mechanical Cleaning

Mechanical cleaning methods using sponges to physically scrub the interior of product lines is NOT recommended due to abrasion. Only Couplers, Shanks, Tailpieces and faucets should be cleaned using cleaning brushes every 4 weeks.

Sonic Line Cleaning Method

Devices that purport to electrically or sonically clean draft lines are not a suitable substitute for chemical line cleaning. Although some sonic cleaners may inhibit bacteria and yeast growth, they have little or no cleaning effect on draft hardware and fittings. The success of sonic cleaners can be affected by the Kombucha style and length of system, and can be interrupted by metal components in the system. Sonic cleaners may add some benefit to deter certain types of bacteria while having little to no effect on others. **A maximum four-week**

chemical line cleaning cycle is recommended on all draft systems regardless of the use of a sonic cleaner.

All "automatic" cleaning systems or clean-in-place (CIP) systems should be able to achieve all recommendations included in this chapter, including a maximum four-week cleaning cycle, 15 minutes of recirculation, and disassembly and detailing of all hardware.

Line Replacement and Material

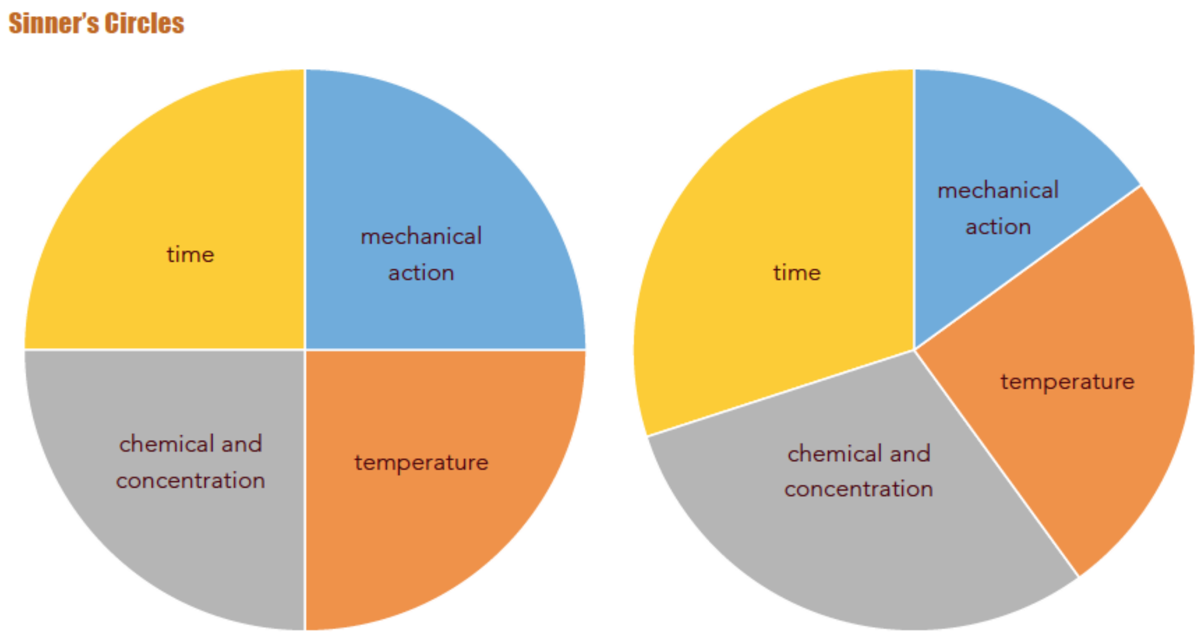
- All poly vinyl jumpers and poly vinyl direct-draw lines should be checked every year and replaced anytime there is buildup, flavor contamination or staining of the lines.
  - For example, turmeric can create a flavor contamination if switching between flavors.
- All long-draw trunk line should be replaced in the following instances:
  - When the system is 10 years or older.
  - When flavor changes are imparted in a Kombucha draft line from an adjacent draft line.
  - When any line chronically induces flavor changes in Kombucha.
- Draft lines may need to be replaced after pouring strong flavored Kombuchas, margaritas, wines, or ciders. Such beverages may permanently contaminate a draft line and possibly adjacent draft lines in the same bundle. Such contamination precludes future use of that draft line for Kombucha.
- In the case where a coupler's gas backflow valve (Thomas valve) is or ever has been missing, the gas line and regulator may have been compromised and should be replaced.
- Ensure the material used in the manufacture of the draft product lines is compatible with the chemicals, dilution rates, and temperatures outlined on the following pages (also see "product line" in Chapter 1).

Detailed Recommendations

Time, temperature, mechanical action, and chemicals (including concentration) are the four interdependent factors that determine draft system cleaning effectiveness. These four factors are known as the 'Sinner's Circle' and are represented in the shape of a circle.

If one factor is reduced, the loss must be compensated for by increasing one or more other factors. For example, if mechanical action is lost because a recirculation pump is not used, the chemical concentration and contact time may need to be increased to account for the loss. Throughout this chapter, these four interdependent factors will be referenced.

The following sections detail more specific recommendations on draft line cleaning. We begin with the basic issue of tasks and their frequency, then move into the more involved questions of cleaning solutions and procedures. The final pages of this chapter detail the procedures for electric pump and pressure pot cleaning.



Cleaning Frequency and Tasks

- ❏ Every four weeks (~30 days)
  - ❏ All faucets should be completely disassembled and cleaned.
  - ❏ All keg couplers or tapping devices should be scrubbed clean.
  - ❏ All FOB-stop devices (a.k.a. beer savers, foam detectors) should be cleaned in line. Chemicals should be purged through the FOB-stop and vented out of the FOB drain hose.
- ❏ Semi-annually (every six months)
  - ❏ Draft lines should be cleaned with a caustic line-cleaning chemical following the procedures outlined in this chapter.
  - ❏ All FOB-stop devices (a.k.a. Beer savers, foam detectors) should be completely disassembled and hand-detailed (cleaned).
  - ❏ All couplers should be completely disassembled and detailed.

More aggressive cleaning schedules and practices may be needed for older systems, problematic systems, or when proper line cleaning practices are not in place.

Cleaning Solutions and Their Usage

Caustic-Based Cleaning Chemistry

- Caustic chemicals remove organic material from the interior of the draft line, hardware, and fittings. The removal of the SCOBY buildup keeps the lines free from excess matter clogging the lines.
- Use a caustic cleaner that uses either **sodium hydroxide, potassium hydroxide, or a combination of both** and is specifically designed for draft line cleaning.

- **Never use solutions that contain any amount of chlorine for line cleaning**. Chlorine is not compatible with some product line materials, and residual chlorine can cause flavor changes in draft Kombucha.
- Based on brewery and independent lab testing by the Brewers Association, they recommend **mixing caustic-based line cleaning solutions to a working strength of at least 2% caustic (as sodium hydroxide)**.
    - A 3% caustic solution is more appropriate for problem systems, heavily soiled systems, systems with older lines, or for any line that imparts a flavor change to the Kombucha served from it.
    - Chemical manufacturers should provide detailed mixing instructions on the bottle for 2% and 3% caustic solutions.
    - If this information is not available, contact your chemical manufacturer to determine how much chemical is needed to achieve these recommended concentrations.
- Use portable titration kits or pH strips/meter to confirm the working caustic strength of product line-cleaning solutions.
- Mix caustic solution with water warmed to a temperature between 80º-110ºF (26º-43ºC).
- Caustic cleaner must remain in contact with the draft line for at least:
    - 15 minutes when solution is being recirculated, and
    - 20 minutes for static or pressure pot cleaning.

Water Rinsing

- Always flush draft lines with fresh water before pumping chemical into the line.
- Always flush draft lines with water **after** using any chemical solution (caustic).
- Continue water flushing until:
    - No solid matter appears in the rinse water.
    - No chemical residue remains in the draft line.
- Confirm chemical removal by testing the solution with pH strips or a pH meter.
    - Before beginning the rinse, draw a reference sample of tap water and test its pH.
- During rinsing, test the rinse water exiting the draft system periodically.
    - When the pH of the rinse water matches that of the tap water, the chemical is fully flushed out.
- **Chemical solution must never be flushed from draft lines with Kombucha.**

Cleaning Methods and Procedures

Because every draft Kombucha system is different, there is no definitive procedure for cleaning them. There are, however, certain principles that apply to cleaning every system. To be effective, cleaning solutions need to reach every inch of product line and every nook and cranny of the connectors and hardware.

You can hand clean some items like couplers and faucets, but most of the system must be reached by fluid flowing through the product lines. The industry currently uses two cleaning procedures for product lines: recirculation by electric pump, and static or pressure pot cleaning.

Electric recirculating pump cleaning is recommended as the preferred method for nearly all systems. Recirculation pump cleaning uses the combination of chemical cleaning and mechanical action to effectively clean a draft system, by increasing the normal flow rate through the product lines during the cleaning process.

While static or pressure pot cleaning is an alternative, it is significantly less effective and is not a recommended method for cleaning. This procedure requires additional time to ensure that the cleaning solutions have the right contact time in line, to make up for the lack of mechanical force.

Key Considerations in Setting up an Electric Recirculating Pump Cleaning

- The chemical flow should be the reverse of the Kombucha flow wherever possible. Ideally, the flow direction should be alternated between cleanings.
- Ideal chemical flow rate achieves twice the flow rate of the Kombucha. In standard systems, Kombucha flows at 1 gallon per minute (gpm), and **ideal chemical flow rate is 2 gpm**. 2 gpm may not be attainable for all systems. In these cases, a minimum of 1 gpm should be achieved.

The flow rate can be controlled by:

- Minimizing the number of draft lines cleaned at one time.
- Increasing the size of the pump used.

The flow rate can be tested in a 15-second test. Multiply the volume of liquid dispensed by 4 to determine the ounces or gallons per minute (1 gallon = 128 ounces).

- The pressure on the draft lines during recirculation should never exceed 60 psi.
- Under these conditions, chemical solution should recirculate for a minimum of 15 minutes.

Static or pressure pot cleaning offers an alternative method to clean runs of less than 15 feet. This requires 20 minutes of contact time with the cleaning solutions to make up for the lack of circulation.

The remainder of this chapter covers use of these cleaning methods, starting with setup and proceeding to the detailed steps for each procedure.

Before You Start

Regardless of your cleaning methods, some system designs require specific attention before you begin cleaning. Here’s a list of items to check and consider. See the Unique Situations section at the end of this chapter for more details.

- In pneumatic Beer pump systems:
    - Turn off the gas supply to the pumps.

    - On the line(s) to be backflushed, set the pump valve or flow diverter orientation to "Backflush" so that cleaning solution may flow through the pump body in the appropriate direction as needed.
- All legs in "split lines" (lines that are "teed" in the cooler or under the bar to feed more than one faucet from a single keg) must be cleaned as completely separate draft lines.

Electric Recirculation Pump Cleaning Step-By-Step Procedure

1. Begin by connecting two keg couplers with a cleaning adapter or cleaning cup.
    a. Cleaning adapters are available to accommodate many different combinations of coupler types, with the most common being "D" type to "D" type as shown.
    b. Do not engage the couplers, or cleaning solution may travel up the gas line. The shaft on each side of the adapter raises the check ball within the coupler (see diagram on page 16) to allow cleaning solution to flow in either direction.
    c. If cleaning four lines, connect a second set of lines with another cleaning coupler, creating a second "loop." **Cleaning more than four lines at once is not recommended**, as it will be difficult to achieve the proper chemical flow rate.
    d. To clean the lines and couplers used for series kegs, connect the couplers attached to the gas lines and place series caps with check ball lifters on all other couplers.
2. On the corresponding lines at the bar, remove both faucets from their shanks.
    a. For loops with long and/or numerous lines, prime pump by filling pump and pump jumper lines completely with water before attaching "Out" hose to shank.
    b. When cleaning two lines, attach the "Out" hose from the pump to one shank and a drain hose or spare faucet to the other shank.
    c. When cleaning four lines, attach the "Out" hose from the pump to one shank, connect the other shank in the loop to a shank in the second loop with a "jumper" hose fitted with two cleaning adapters (one on each end), and attach a drain hose or spare faucet to the remaining shank in the second loop.
    d. When cleaning four lines, ensure that the drain hose and "Out" hose from the pump are not on the same coupler "loop."
3. Fill a bucket ("Water Bucket") with warm water and place the "In" hose into the water.
    a. Turn pump on and flush Kombucha into a second bucket ("Chemical Bucket") until the line runs clear with water.
    b. Shut pump off and discard the flushed Kombucha.
4. Turn pump back on, allowing warm water to run into the clean Chemical Bucket.
    a. Measure the flow rate of the liquid by filling a Kombucha pitcher or some container with a known volume. A steady flow rate that ideally exceeds the flow rate of the Kombucha is recommended.
    b. If cleaning is configured for four lines and flow rate is too slow, remove the jumpers and clean each pair of lines separately.
    c. Allow bucket to fill with just enough water to cover the inlet hose of the pump.
    d. Add the appropriate amount of line cleaning chemical to achieve 2-3% caustic in solution based on age and condition of product line.
5. Remove the "In" hose from the Water Bucket and place into the Chemical Bucket.
    a. There should now be a closed loop.
    b. Solution should be draining into the same bucket that the pump is pulling from.

6. Allow solution to recirculate for a minimum of 15 minutes. While waiting:
    a. Purge circulating solution through FOB-stop devices and ensure FOBs are filled with chemical and vented out of the FOB drain hose.
    b. Clean your faucets.
    c. Fill Water Bucket with cold water.
7. Begin your rinse by removing the "In" hose from Chemical Bucket and placing it into the Water Bucket (filled with cold water).
8. Continue pumping cold water from the Water Bucket into the Chemical Bucket (shutting off pump and dumping Chemical Bucket as needed) until all chemical has been pushed out of the draft lines and there is no solid matter in the rinse water.
    a. Use pH paper to verify chemicals have been rinsed.
9. Finish up by shutting off the pump, detaching the cleaning coupler, and replacing the faucets.

When Finished

Return all system components to their original functional settings; e.g., turn on gas supply to pneumatic Beer pumps, reset FOBs and pneumatic pump flow diverters, etc.

Static – Pressure Pot Step-By-Step Procedure

1. Fill the cleaning canister with clean water.
2. Untap the keg and tap the cleaning canister. Engage the tapping device.
    a. When cleaning series kegs, connect the tapping devices attached to the gas lines and place series caps on all other tapping devices.
3. Open faucet until the Kombucha is flushed out and clear water is pouring.
4. Untap the canister and fill the canister with cleaning chemical mixed to the appropriate strength to achieve 2-3% caustic in solution based on age and condition of product line.
5. Tap the canister again.
    a. Please note: When applying CO_2 to a pressure pot containing a caustic solution, the CO_2 will weaken or neutralize the caustic solution. It is best not to agitate or let it stand in the same container for an extended period.
    b. For the same reason, the use of pressure pots that feature a "spitting" action, whereby CO_2 is injected directly into the outflow of solution, is not recommended.
6. Open the faucet until the water is flushed out and chemical solution is pouring from the faucet.
7. Shut off the faucet.
    a. At this point, it has been common practice that the canister is untapped and faucets are removed and cleaned. **This practice is NOT recommended.** By releasing the pressure from the system, chemical will leak from the system, eliminating chemical contact from all high points of the system.
8. Return to the cooler and purge cleaning solution through FOB-stop devices and ensure FOBs are filled with chemical and vented out of the FOB drain hose.
9. Allow cleaning solution and product line to be in contact for no less than 20 minutes.
10. Untap the canister.
    a. If the system is driven with pneumatic Beer pumps, shut off the gas supply to the pumps to turn them off.

11. Remove the faucet and clean.
12. Replace faucet.
13. Empty, rinse, and fill the canister with clean, cold water and retap.
14. Open the faucet and rinse until all chemical has been flushed out and there is no solid matter in the rinse water. Use pH paper to verify chemicals have been rinsed.
15. Finish by untapping the canister, re-tapping the keg and pouring Kombucha until it dispenses clear.

When Finished

Be sure to return all system components to their original functional settings; e.g., reset FOBs, reset pneumatic beer pump cleaning diverters to dispense setting and turn on pump gas supply, etc.

Unique Situations When Cleaning with a Recirculation Pump

Electric recirculation pump cleaning is recommended as the preferred method for nearly all systems. However, at times the system design can inhibit the ability to effectively clean with a recirculation pump. The following is a guide for cleaning more complex systems with a recirculation pump.

Pneumatic Beer Pumps

Pneumatic beer pumps are not multi-directional, so an alternative, but less effective, way of cleaning split lines is to set up recirculation cleaning on one tower and draw liquid through the remaining split towers.

- When using this method, a traditional recirculation cleaning is set up on one tower using a larger 3 to 5 gallon "chemical bucket."
- The chemical bucket should be nearly filled.
- Using an empty bucket of the same size, chemical will be drawn through the split lines into the empty bucket while simultaneously depleting the chemical bucket.
- Leave enough liquid in your primary chemical bucket to maintain recirculation.
- This step is repeated for each step of the cleaning process, including water pre-rinse, chemical, and water post-rinse.
- Because the split lines are receiving less mechanical action than the recirculation lines, additional time or chemical may be needed to make up for the loss of mechanical action (see Sinner's Circle at beginning of this section).

Split or Y'd lines

The preferred method to clean split lines is to clean each tower as its own separate system. This allows each system to get a complete recirculation clean. When using this method, it is important that the entire system is rinsed at the same time to ensure no residual chemical is caught in a split or "Y".

example fittings for constructing cleaning adapters

Custom cleaning flushers can also be built by using the various components pictured below. Building a custom coupler can also allow for connections between couplers of two different system types. The components pictured would connect a D or S system coupler to an A system coupler. In addition, custom lengths of poly vinyl tubing can be added between components to assist in making connections across large coolers.

example fittings for constructing cleaning adapters

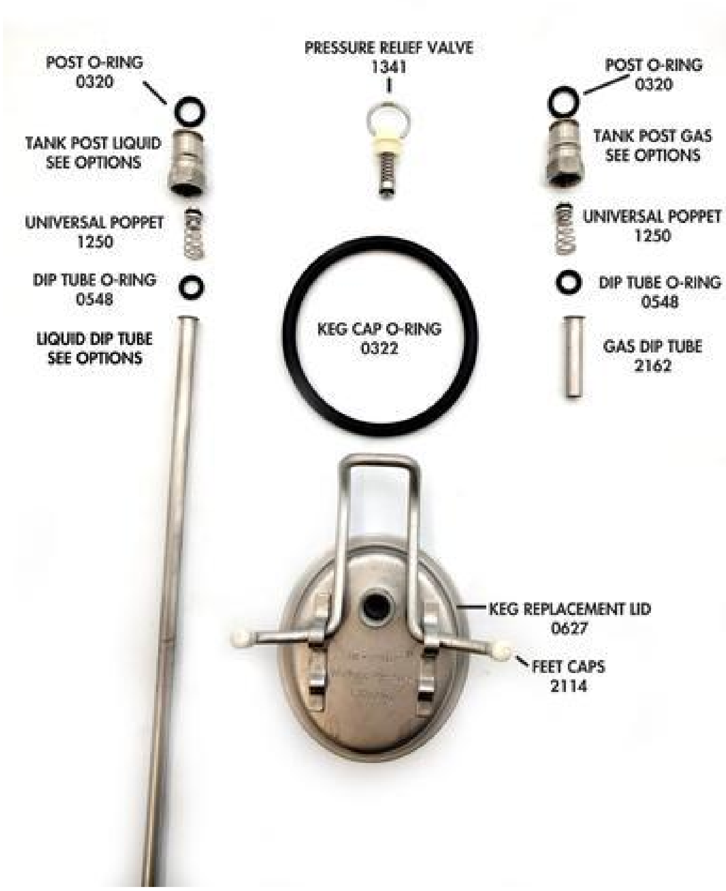
These components can also be used to design a three-way coupler. Traditional recirculation pump cleanings use an even number of lines to create the recirculation loop. A three-way coupler (components pictured) allows for an odd number of lines to be connected by utilizing two drain lines.

Cleaning Cornelius Kegs

While Cornelius kegs are relatively easy to disassemble and clean, kombucha presents a few unique challenges. These kegs were originally designed to distribute Pepsi products, which typically do not have issues with sediment or solid materials. Even under refrigerated conditions, living kombucha continues to ferment, creating sediment and bacteria strains. **These solid materials have the potential to clog the dip tubes and poppets.** While there are several devices on the market for cleaning Cornelius kegs, they are mostly intended for homebrew beer products and they do not have the ability to flush out all of the solid materials.

When a clog occurs while product is being dispensed, the keg may need to be depressurized and disassembled to remove the debris. Opening a keg of finished product to clear a clog presents numerous sanitary issues which could result in the disposal of the remaining product. For those reasons, we make the following recommendations:

1. During cleaning, the liquid and gas posts should be removed.
2. Inspect the poppets for debris.
    a. For stubborn deposits, soaking the parts in a warm solution of Powdered Brewery Wash might be helpful.
3. Remove the liquid and gas dip tubes and inspect for SCOBY growth and bacteria strains.
4. If using a Cornelius keg for fermentation, to prevent sediment clogs, transfer the product to a clean keg prior to distribution.
    a. Filtering the product during this transfer might also help.
5. Utilize cold storage at all times
6. When a keg is finished, clean quickly or store in a cooler to reduce SCOBY growth.



Ball Lock Components

Testing for Cleanliness

The following are a few of the most common ways to test for draft system cleanliness. The below three methods are more important if you are converting an existing beer line to Kombucha to ensure you're starting with a clean draft system. Bacterial infection is not common in kombucha due to its natural properties.

Sensory Evaluation

A thorough sensory evaluation by a trained taster can reveal signs of a bacterial infection in a draft system. See Chapter 8: Troubleshooting for a list of off-flavor descriptions and corresponding bacteria. However, bacterial infections begin long before they are detected by human senses. Draft system maintenance is inherently a preventative maintenance designed to prevent bacterial infections. If only sensory evaluations are used for testing, it may be too late by the time bacteria reveal themselves through detectable tastes and aromas.

ATP Testing

ATP tests can be a convenient and portable way to test for cleanliness in the field. The ATP test is a process of rapidly measuring actively growing microorganisms through detection of adenosine triphosphate, or ATP, using a luminometer. While ATP testing can be an indicator of cleanliness, it is unable to differentiate between Kombucha-spoiling organisms and other naturally occurring, less worrisome organic material.

Color-Indicating Chemicals

Some chemical manufacturers have color-changing chemicals that can provide indicators of a draft system's cleanliness. Similar to ATP testing, these methods are only an indicator of cleanliness and are unable to differentiate between Kombucha-spoiling organisms and other naturally occurring, less worrisome organic material.

These guidelines reflect the key actions needed to maintain draft systems and pour trouble-free, high-quality Kombucha. Before performing these actions, please read and understand the detailed recommendations as they contain many details important to effective and successful cleaning.

Component Cleaning Schedule

Draft line Cleaning

(semi-annually, every 6 months)

Clearly posted documentation of line cleaning and servicing records is recommended in all keg coolers (visit https://tinyurl.com/y5xvab5j for a printable line cleaning log).

1. Push Kombucha from lines with warm water.
2. Clean lines with caustic solution at 2% or greater concentration for routine cleaning of well-maintained lines, or at 3% for older or more problematic lines.

   a. Contact your chemical manufacturer to determine how much chemical is needed to achieve these recommended concentrations.
   b. If you use non-caustic-based cleaners such as acid-based or silicate-based cleaners, be sure to use the cleaning concentrations recommended by the manufacturer.
   c. For best results, maintain a solution temperature of 80º - 110ºF (26º - 43ºC) during the cleaning process.
3. Using an electric pump, caustic solution should be circulated through the lines at a **minimum of 15 minutes** at a steady flow rate that ideally exceeds the flow rate of the Kombucha.
   a. If a static or pressure pot is used (though not recommended), the solution needs to be left standing in the lines for no less than 20 minutes before purging with clean water.
4. Disassemble, service, and hand-clean faucets; hand-clean couplers.
5. After cleaning, flush lines with cool fresh water until pH matches that of tap water and no visible debris is being carried from the lines.
6. **Acid Cleaning found not to be necessary at this time as non-organic matter not found in lines pouring kombucha.**

Hardware Cleaning

(semi-annually, every six months)

- Disassemble, service, and hand-clean all FOB-stop devices (a.k.a. beer savers, foam detectors).
- Disassemble, service, and hand-clean all couplers.

Chapter 8: Troubleshooting

Perfectly poured draft Kombucha is the result of proper temperature, gas pressure and mixture, and a well-maintained draft Kombucha system. It's easy to take all the variables for granted when Kombucha is pouring well. But improperly pouring Kombucha can be very frustrating, and can result in loss of sales. This chapter is intended to provide useful troubleshooting steps anyone can follow to solve draft Kombucha dispense problems.

The single most common cause of problems encountered in draft Kombucha dispense systems is temperature control. The first step in solving any dispensing problem is to confirm that the temperature of the keg and the cooler are where they are supposed to be. In air-cooled and glycol-cooled systems, the next step is to check the temperature of the Kombucha being delivered to the faucet, confirming that the air and glycol systems used to maintain proper product line temperature are working properly.

The troubleshooting steps that follow are organized by the type of draft Kombucha system and how the systems are cooled, using air or glycol. Direct-draw systems and long-draw systems cooled by air or glycol each have unique features that are addressed in the troubleshooting steps.

Other steps including gas pressure and supply, Kombucha supply, and mechanical issues are also discussed.

For air-cooled systems, the maximum recommended distance for a double-duct system is 25 feet (tube side by side) and for a single-duct system is 15 feet (tube within a tube).

A glycol system is designed to maintain liquid Kombucha temperature from the cooler to the point of dispense.

DIRECT DRAW SYSTEMS		
Problem	**Possible Cause**	**Possible Solution**
Product Foaming	Temperature too warm (should be 38° F)	Adjust temperature control or call a qualified service person
	Temperature too cold/frozen product in lines (should be 38° F)	Adjust temperature control or call a qualified service person
	Kinked product line	Change product line
	Wrong diameter or length product line (should be 6 to 7 ft. of 3/16" vinyl tubing or possibly even longer)	Change product line

	Applied pressure too high (should be 12 to 14 psi)	Adjust CO_2 regulator to brand's specification
	Applied pressure too low (should be 12 to 14 psi)	Adjust CO_2 regulator to brand's specification
	Coupler washers bad	Replace coupler washers
	Faucet washer bad	Replace faucet washers
	System dirty	Clean system or call customer's line cleaning service
	CO_2 leaks or out of CO_2	Check fittings, clamps, shut-offs and regulators, replace as necessary
	Foaming in jumper – keg valve seal torn or ripped	If seal is ripped/torn, gas enters the liquid flow stream causing foaming. Replace keg and report defective keg to distributor
	Foaming in jumper - physical obstructions at coupler-valve junction	Remove any physical obstructions or debris (e.g. a piece of a dust cover) that could allow gas to enter the liquid flow
	Foaming at faucet – clogged vent hole(s)	Disassemble and clean faucet, or call line cleaning service
No Product at Faucet	Empty CO_2 bottle	Replace with full CO_2 bottle
	Regulator shutoff closed	Open shutoff
	CO_2 bottle main valve turned off	Turn on CO_2 bottle main valve
	Keg empty	Replace with full keg
	Coupler not engaged	Tap keg properly and engage coupler
	Check ball in coupler stuck	Free check ball
	Line/faucet dirty	Clean line/faucet

For air-cooled systems, the maximum recommended distance for a double-duct system is 25 feet (tube side by side) and for a single-duct system is 15 feet (tube within a tube).

AIR-COOLED SYSTEMS

Problem	Possible Cause	Possible Solution
Product Foaming	Check temperature at faucet - too warm (should be 38° F)	Blower fan air flow obstructed
		Adjust temperature control or call qualified service person
		System designed improperly: too long, wrong size fan, etc.
	Check if temperature at faucet is too cold (should be 38° F)	Adjust temperature control or call qualified service person
	Kinked product line	Change product line
	Wrong size product line	Change product line
	Applied pressure too high (should be 12 to 14 psi)	Adjust CO_2 regulator to brand's specification
	Applied pressure too low (should be 12 to 14 psi)	Adjust CO_2 regulator to brand's specification
	Wrong gas (mixed gas blenders recommended)	Change to mixed gas blender, use target pressure
	Coupler washers bad	Replace coupler washers
	Faucet washer bad	Replace faucet washers
	System dirty	Clean system or call customer's line cleaning service
	Foaming in jumper – keg valve seal torn or ripped	If seal is ripped/torn, gas enters the liquid flow stream, causing foaming. Replace keg and report defective keg to distributor
	Foaming in jumper - physical obstructions at coupler-valve junction	Remove any physical obstructions or debris (e.g. a piece of a dust cover) that could allow gas to enter the liquid flow
	Foaming at faucet – clogged vent hole(s)	Disassemble and clean faucet, or call line cleaning service
No Product at Faucet	Empty CO_2 bottle, N_2 bottle, or mixed gas bottle	Replace with appropriate full gas bottle

	Regulator shutoff closed	Open shutoff
	Gas bottle main valve turned off	Turn on gas bottle main valve
	Keg empty	Replace with full keg
	Coupler not engaged	Tap keg properly and engage coupler
	Check ball in coupler stuck	Free check ball
	Line/faucet dirty	Clean line/faucet

A glycol system is designed to maintain product temperature from the cooler to the point of dispense.

GLYCOL-CHILLED SYSTEMS

Problem	Possible Cause	Possible Solution
Product Foaming	Check temperature at faucet - too warm (should be 38° F)	Check glycol chillers for proper operation; adjust glycol bath temperature if too warm (most systems are designed to operate between 28° and 34° F; check unit's manufacturer specs)
		Adjust temperature control or call qualified service person
	Check temperature at faucet - too cold (should be 38° F)	Check glycol chillers for proper operation; adjust glycol bath temperature if too cold (most systems are designed to operate between 28° and 34° F; check unit's manufacturer specs)
		Adjust temperature control or call qualified service person
	Wrong gas (glycol systems usually require a mixed gas blender)	Change to mixed gas blender, use target pressure
	Glycol pump functioning (check return line)	Call qualified serviceman to adjust glycol chiller temperature or operation
	Gas regulators incorrectly set	Contact installer
	Applied pressure too low (should be 12 to 14 psi)	Adjust CO_2 regulator to brand's specification
	Coupler washers bad	Replace coupler washers
	Faucet washer bad	Replace faucet washers

	System dirty	Clean system or call customer's line cleaning service
	Power pack – check condenser, glycol concentration	Call qualified serviceman to clean clogged condenser fins, check glycol strength, service glycol chiller
	Foaming in jumper – keg valve seal torn or ripped	If seal is ripped/torn, gas enters the liquid flow stream causing foaming. Replace keg and report defective keg to distributor.
	Foaming in jumper - physical obstructions at coupler-valve junction	Remove any physical obstructions or debris (e.g. a piece of a dust cover) that could allow gas to enter the liquid flow
	Foaming at faucet – clogged vent hole(s)	Disassemble and clean faucet, or call line cleaning service
No Product at Faucet	Empty CO_2 source, N_2 source, or mixed gas bottle	Replace with appropriate full gas bottle, refill bulk CO_2 or N_2 receiver, check nitrogen generator
	Regulator shutoff closed	Open shutoff
	Gas bottle or bulk tank main valve turned off	Turn on gas bottle or tank main valve
	Keg empty	Replace with full keg
	Coupler not engaged	Tap keg properly and engage coupler
	Check ball in coupler stuck	Free check ball
	Line/faucet dirty	Clean line/faucet
	FOB detector	Reset FOB detector
	Pneumatic beer pumps	Check gas supply to pumps; check pump diverter setting

Appendix A: ISBT Guidelines for Beverage Grade Carbon Dioxide

All specifications based on volume (v/v) unless otherwise noted.

Purity	99.9% min
Moisture	20 ppm max
Oxygen	30 ppm max
Carbon Monoxide	10 ppm max
Ammonia	2.5 ppm max
Nitric oxide/nitrogen dioxide	2.5 ppm max each
Nonvolatile Residue	10 ppm (wt) max
Nonvolatile organic residue	5 ppm (wt) max
Phosphine	0.3 ppm max
Total volatile hydrocarbons	50 ppm max
Acetaldehyde	0.2 ppm max
Aromatic hydrocarbon	20 ppb max
Total sulfur content	0.1 ppm max
Sulfur dioxide	1 ppm max
Odor of solid CO_2	No foreign odor
Appearance in water	No color or turbidity
Odor and taste in water	No foreign taste or odor

Appendix B: C02 Gauge Pressure, Temperature and Carbonation Level Reference Chart

Table 1. Determination of CO_2 equilibrium pressure given volumes of CO_2 and temperature

Vol. CO_2	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
Temp. °F	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi	psi
33	5.0	6.0	6.9	7.9	8.8	9.8	10.7	11.7	12.6	13.6	14.5
34	5.2	6.2	7.2	8.1	9.1	10.1	11.1	12.0	13.0	14.0	15.0
35	5.6	6.6	7.6	8.6	9.7	10.7	11.7	12.7	13.7	14.8	15.8
36	6.1	7.1	8.2	9.2	10.2	11.3	12.3	13.4	14.4	15.5	16.5
37	6.6	7.6	8.7	9.8	10.8	11.9	12.9	14.0	15.1	16.1	17.2
38	7.0	8.1	9.2	10.3	11.3	12.4	13.5	14.5	15.6	16.7	17.8
39	7.6	8.7	9.8	10.8	11.9	13.0	14.1	15.2	16.3	17.4	18.5
40	8.0	9.1	10.2	11.3	12.4	13.5	14.6	15.7	16.8	17.9	19.0
41	8.3	9.4	10.6	11.7	12.8	13.9	15.1	16.2	17.3	18.4	19.5
42	8.8	9.9	11.0	12.2	13.3	14.4	15.6	16.7	17.8	19.0	20.1

Based on Data from "Methods of Analysis," American Society of Brewing Chemists, 5th Edition - 1949

- Also Reference McDantim EasyBlend App.
- It's important to remember that carbonation is proportional to absolute pressure, not gauge pressure. Atmospheric pressure drops as elevation goes up. Therefore, the gauge pressure needed to achieve proper carbonation at elevations above sea level must be increased. Add 1 psi for every 2,000 feet above sea level. For example, a retailer at sea level would use 11.3 psi gauge pressure to maintain 2.5 volumes of CO_2 in Kombucha served at 38º F. That same retailer would need 13.3 psi gauge pressure at 4,000 feet elevation to maintain 2.5 volumes of CO2.

Figuring ideal gauge pressure of straight CO2 when carbonation level is not known:

1. Set the regulator pressure to 5 psi.
2. Tap a fresh keg. Make sure the keg has been in the cooler long enough to be at the cooler. A first approximation can be found by assuming that CO2 has a molar mass of 44 grams per mol and that one mol of gas at STP conditions (0oC, 1 ATM) occupies a volume of 22.4 liters. Converting from g/L to v/v is then temperature.
3. Pour a small amount of Kombucha through the faucet.
4. Observe the Kombucha in the draft line directly

1g CO2
1L Kombucha

1mol CO2 44g CO2
22.4L

1mol CO2
22.444= 0.50

above the keg coupler (with a flashlight if necessary), inspecting for bubbles rising up from the Kombucha in the keg. Inverting this value gives us the conversion factor for converting from v/v to g/l.

5. If bubbles are present, raise the regulator pressure 1 psi. 10.509**= 1.965**

6. Repeat steps 3 - 5 until no bubbles are present.
7. Check the keg temperature 24 hours after setting the initial gauge pressure to assure temperature stability, and to reset the gauge pressure as needed due to a change in keg temperature.

   This is the lowest pressure at which the gas in the Kombucha is not escaping. This is your ideal gauge pressure.

Appendix C: Carbonation, Blended, Gas, Gas Laws & Partial Pressures

Carbonation

In general, the amount of carbonation in Kombucha depends primarily on the pressure of CO2 applied to the keg of Kombucha being dispensed, and the temperature of the Kombucha. In reality, many other factors can also affect carbonation levels including blended gas proportion of CO2, alcohol content, and specific gravity. Knowing a bit about these factors can help you fine-tune your draft dispense system to achieve the perfect pour for every brand dispensed.

Temperature

In general, gas is less soluble in liquid as the temperature rises. This seems obvious—a nice cold keg of Kombucha dispenses easily, while that same keg of Kombucha dispenses as foam if it gets warm.

Proportion of CO2 in blended gas

This is directly related to the pressure of the CO2 in the headspace over the Kombucha within the keg. Two different gas laws (Dalton's Law of Partial Pressures and Henry's Law) can help us make sense of what's going on. This is most easily described by example, along with a little math. Consider a situation in which a keg of Kombucha is dispensed using gas at 10 psi. If pure CO2 is used to dispense

Kombucha, then all of the pressure on that keg is due to CO2. But what if the gas being used is a blend of 75% CO2/ 25% N2? In this case, Dalton's Law can help us figure out what's going on. Dalton's Law of partial pressures says that *the total pressure exerted by a gaseous mixture is equal to the sum of the partial pressures of each individual component in a gas mixture*. This means the partial pressure of CO2 is equal to the proportion of CO2 in the gas, in this case 75%, times the total absolute pressure of the blended gas, or 34.7 psia (10 psig +14.7 psi atmospheric pressure = 24.7 psia). In this case, the partial pressure of CO2 is:

75% x 24.7 psia = 18.5 psia

18.5 psia – 14.7 psi atmospheric = 3.8 psi gauge.

So, in this example using blended gas, the carbonation of the Kombucha will be proportional to 3.8 psi of CO2, NOT 10 psi CO2. It's important to note this calculation must be done in absolute pressure, then converted to gauge pressure (if you used gauge pressure of 10 psi rather than 34.7 psia, 75% of that value would result in 7.5 psi as the partial pressure of CO**2** in this scenario, which is not correct.) Consulting the carbonation chart on page 69 and assuming a temperature of 38 °F and 3.8 psi CO2 pressure, the carbonation level in this example would be 2.38 volumes (rather than 2.10 volumes, which would be the 7.5 psi result if you had incorrectly used gauge pressure).

Alcohol Content and Specific Gravity

Most of the liquid in Kombucha is water. The standard carbonation table is based on Kombucha containing 4.8% alcohol by volume (abv), where approximately 95% of the liquid is water. As it turns out, CO2 is more soluble in ethanol than it is in water, which by itself would increase the solubility of CO2 in the Kombucha as abv increases. The degree to which solubility is affected in different Kombuchas is hard to calculate, however, due to the opposing effects of a Kombucha's density on CO2 solubility.

Specific gravity, or the density of the Kombucha, is affected by other compounds in solution, such as carbohydrates and proteins that provide mouthfeel, body, color and flavor. As the density of Kombucha increases, there is effectively less liquid available in which CO2 can dissolve. While not always the case, high abv Kombuchas tend to have a higher specific gravity. Therefore, a high abv Kombucha may have an increased CO2 solubility from the alcohol content, but that effect is outweighed by the opposing decrease in solubility from increased density of carbohydrates, proteins and other compounds within the Kombucha.

Blended Gas Dispense Examples

Henry's Law states: *"At a constant temperature, the amount of a given gas that dissolves in a given type and volume of liquid is directly proportional to the partial pressure of that gas in equilibrium with that liquid."* This turns out to be really useful when dispensing Kombucha in systems where more than 12-15 psi of dispense pressure is needed to move Kombucha to the taps, such as long-draw systems.

The partial pressure of a gas within a blend can be calculated by multiplying the total pressure of the gas blend (in psia, not psig) times the proportion of that gas in the blend. Let's consider a couple of scenarios in which draft Kombucha is 1) dispensed using blended gas at 70% CO2/ 30% N2, and 2) dispensed using straight CO2. In both scenarios, let's assume the dispense temperature is the same at 39ºF, and that the system has been designed and balanced to dispense Kombucha at an operating pressure of 20 psig, or, 10 + 14.7 = 24.7 psia.

Scenario 1:

Dispensing with blended gas at 70% CO2/30% N2 The carbonation in the Kombucha will depend on the partial pressure of CO2, which equals 24.7 psia (the total dispense pressure) x 70% (proportion of CO2 in the blend) = 17.3 psia. At sea level, atmospheric pressure is 14.7 psi; 17.3 psia – 14.7 = 2.5 psig. A partial pressure of 2.5 psi for CO2 at 38ºF would result in about 2.3 volumes of carbonation in Kombucha. For most brands of Kombucha, this carbonation rate is a bit lower than typical values of 2.5 – 2.7 volumes.

Scenario 2:

Dispensing with straight CO_2

The carbonation in the Kombucha will depend on the partial pressure of CO_2, which equals 34.7 psia (the total dispense pressure) x 100% (proportion of CO_2 in the blend) = 34.7 psia. At sea level, atmospheric pressure is 14.7 PSI; 34.7 psia – 14.7 = 20 psig. A partial pressure of 20 psi for CO_2 at 38ºF would result in about 3.3 volumes of carbonation in Kombucha. For most brands of Kombucha, this carbonation rate is a bit higher than typical values of 2.5 – 2.7 volumes.

From these examples, we can see that at the operating parameters of the system in question, straight CO_2 would result in carbonation levels that are too high. The blend we chose, at 70% CO_2, would result in carbonation levels that are a bit too low. So, is there a way to use Henry's Law to figure out the exact blend for our draft Kombucha system? And, looking at this another way, is there a way to use this math to figure out the ideal pressure to use, given a certain blend of gas?

As it turns out, there are tools available online to do both of these tasks with a great degree of accuracy. There are also some relatively straightforward calculations that do the same things very quickly, shown here. The following equation is very useful for converting back and forth between gauge pressure and absolute pressure, and proportion of CO_2 in a blend:

b + 14.7

In this case, a gas blender with more than one blend of mixed gas would be very helpful. You would use the 77% CO_2 to dispense the Kombuchas with 2.5 volumes of carbonation, and the 83% blend to dispense the Kombuchas with 2.7 volumes of carbonation.

Determining the correct pressure for a given blend of CO_2 / N_2 mixed gas

c =**a + 14.7**, where

a = gauge pressure of the blended gas;

b = ideal gauge pressure of straight CO_2 (from the carbonation table in Appendix B);

c = % of CO_2 in the blend

Determining the ideal blend of CO_2/ N_2 mixed gas for a given draft Kombucha dispense system.

Let's get back to our example above, in which a draft Kombucha dispense system was designed to operate at 39ºF, and at 20 psig. Let's also assume that the Kombuchas being poured contain 2.5 volumes of CO_2.

From the carbonation table, we see that a Kombucha at 2.5 volumes of CO_2 at 39ºF has an equilibrium pressure of 11.9 psi of CO_2. So now we know that a = 20 psi, and b = 11.9 psi.

What if in the above example, we only had access to one blend of gas? Could we adjust the pressure a bit to achieve more than one level of carbonation, and still dispense Kombucha in the same draft Kombucha system? Well, maybe. This is very similar to the procedure outlined on Page 27 of this manual. Let's get back to our example above, in which a draft Kombucha dispense system was designed to operated at 39º F and at 20 psig. We want to dispense Kombuchas containing both 2.5 and 2.7 volumes of CO_2.

From the above example, we know that the 77% CO_2 blend is correct for the 2.5 volume Kombuchas. What pressure would we have to use to correctly dispense Kombuchas with 2.7 volumes of CO_2 using this 77% blend?

Looking back at our equation:

c = b + 14.7
a + 14.7 , where
c = 11.9+14.7 = 20+14.7
26.6
34.7
= .767 or 77% CO2
rounding up

a = gauge pressure of the blended gas; in this case, a is our unknown
b = ideal gauge pressure of straight CO2 (from the car-

What if we wanted to also dispense Kombuchas with 2.7 volumes of CO2 in this same retail establishment? From the carbonation table, we see that a Kombucha at 2.7 volumes of CO2 at 39ºF has an equilibrium pressure of 14.1 psi of CO2. In this case, a = 20 psi, and b = 14.1 psi.

Donation table in Appendix B); in this case, b = 14.1 c = % of CO2 in the blend; in this case, c = 0.77

a = (b + 14.7)/c – 14.7 a = 28.8/.77 – 14.7
a = 37.4 – 14.7
a = 22.7 psi

c = 14.1+14.7 = 20+14.7

28.8
34.7

= .830 or 83% CO2

So in theory if we increase the dispense pressure from 20 psi up to 22.7 psi on those kegs of Kombucha with 2.7 volumes of CO2, we could use the same 77% CO2 blend to dispense them and maintain proper carbonation. This may or may not work in reality—the Kombucha might pour too fast at the bar, creating turbulence within the glassware. Or it might result in an acceptable pour with the right amount of carbonation. Experimentation at the bar would reveal if the pressure increase worked, or if an additional blend were needed to pour these Kombuchas. n

Draft Kombucha Glossary

Acid Cleaner – Although several blends of acid cleaners are recommended to assist in water stone removal, some acids react with system components. Phosphoric acid-based blends are the only ones safe on all materials. Beer needs Acid Cleaner, Kombucha has not been shown to

Balance – Ensuring that the applied pressure matches the system requirements so that the Kombucha dispenses at the optimum rate of about 2 ounces per second or 1 gallon per minute while maintaining brewery- specified carbonation level.

Ball Lock Keg - An older style of keg formerly used in the soda industry. Ball lock Cornelius kegs use a ball lock disconnect to connect and disconnect to the liquid and gas lines. Ball lock disconnects lock on by lifting the collar up, pushing it on the post and then releasing the collar.

Barrier Tubing – Plastic tubing with a lining of nylon or PET that provides a gas barrier to better protect the Kombucha from oxidation.

Beer Pump – A mechanical pump that is generally driven by compressed air or CO2 that can move Kombucha great distances without changing the dissolved gases.

Caustic or Caustic Soda or NaOH – Sodium hydroxide – a high pH chemical commonly used in blending draft line cleaning solutions that will react with organic deposits in the draft product line. Very effective, but also very dangerous. Commonly used in oven cleaners.

Caustic Potash or KOH or Potassium Hydroxide - Similar to sodium hydroxide, but offers slightly different chemical properties in a blended cleaning solution.

CO_2 – Carbon dioxide, a natural product of fermentation and the gas used to push Kombucha in draft Kombucha systems. CO_2 leaks in the gas system are dangerous because high concentrations of CO_2 will displace air and cause asphyxiation.

CO2 Volumes – The concentration of CO_2 in Kombucha expressed as volumes of gas at standard conditions per volume of Kombucha.

Coil Box – A cooling system to bring Kombucha to serving temperature at the point of dispense consisting of a coil of stainless steel immersed in ice water. Often used at picnics or events where normal keg temperature cannot be maintained.

Coupler – The connector to the keg.

Dewar – An insulated, pressurized container for liquified gas such as CO_2.

Direct Draw – A draft Kombucha system that has a short jumper connection from the keg to the faucet.

Faucet – The dispensing end of the draft Kombucha system that controls the flow of Kombucha.

FOB – Foam on Beer detector. A device that stops the flow of Kombucha when the keg is empty before the product line is filled with foam.

Glycol or Propylene Glycol – A food-grade refrigerant that is recirculated through insulated tubing bundles to maintain Kombucha temperature.

ISBT – International Society of Beverage Technologists, who created a quality standard for CO2 for beverage use.

Jockey Box – A cooler with a cooling coil or cold plate and faucets to chill the Kombucha at the point of dispense.

John Guest Fittings – A specific brand of quick connect for stiff plastic tubing.

Jumper Tubing – The flexible piece of vinyl tubing used between the keg and draft Kombucha system that should be replaced annually.

Lift – The change in height from the keg to the faucet that is a component of system balance.

Line – Tubing that makes up the draft Kombucha flow path.

Long Draw – A draft Kombucha system over 50 feet long that uses barrier tubing in a refrigerated bundle that typically requires a mixed gas to avoid over-carbonation.

Nitrogen Generator – A system designed to separate nitrogen from compressed air, typically by membrane. Nitrogen used for Kombucha dispense in a mixed gas application must be >99% pure.

NSF – National Sanitation Foundation: An organization that certifies food service equipment for performance and cleanability.

Party Pump or Picnic Pump - A hand pump that uses compressed air to dispense Kombucha. This type of pump should only be used when the entire keg will be dispensed at one time, because oxygen will damage the Kombucha.

PE – Polyethylene – Stiffer tubing used in older refrigerated bundles (this oxygen-permeable material contributed to oxidation of the Kombucha remaining in the lines and is now only recommended for use as glycol tubing).

Pot – Pressure Pot, Cleaning Pot – A canister for cleaning solution or rinse water that is connected to a pressure source pushing the solution through the lines like Kombucha. Does not give sufficient velocity for (mechanical) cleaning, so this should only be used on short lines with longer chemical exposure.

PSI – Pounds per square inch. A unit of measure of gas pressure.

PSIA – Pounds per square inch, absolute. A measure of gas pressure against a perfect vacuum so it includes the atmospheric pressure of 14.7 psi at sea level.

PSIG – Pounds per square inch, gauge. A measure of gas pressure against the atmospheric pressure, typically seen on gas regulator gauges. Since atmospheric pressure varies with altitude, the gauge pressure must be adjusted with altitude.

PVC – Polyvinyl Chloride – Flexible jumper tubing.

Regulator – A gas control valve that delivers a set gas pressure regardless of tank pressure. There may be a primary regulator on the gas source and a secondary regulator at the gas connection for each keg.

Resistance (or System/Component/Line Resistance) – A measure of the pressure drop across a component or over a length of tubing at the optimum Kombucha flow rate.

Sanitizer – An EPA-registered product that is designed to kill microorganisms.

Sankey – The modern style of keg coupler. It is available in several versions to fit specific styles of keg valves produced in Europe and the U.S.

Sequestrants – Chemicals that hold metal ions in solution and prevent mineral deposits.

Series Kegs – Hooking multiple kegs together so the Kombucha from the first flows through the second and then into the next so that the kegs can be changed less frequently.

Shank – The connecting piece that goes through the cold box wall or tower and connects the tubing and tail piece to the tap. It also can help provide system pressure reduction.

Short Draw – A draft system under 50 feet long that can be run on straight CO2 or mixed gas, and can use air-cooled or refrigerated lines.

Surfactants – Compounds used in blended draft product line cleaners that lower surface tension to enhance surface wetting, break the bond between deposits and the tubing surface, and suspend soils in cleaning solution so they can be removed.

Tail Pieces – The connectors that allow a piece of tubing to be attached to a piece of equipment.

Tap – The connector from the draft system to the keg (referred to as a coupler).

Tower – The mount on the bar that holds the faucets and is cooled to maintain Kombucha temperature up to the point of dispense.

Water Conditioners – A component of a blended cleaner that is intended to carry away soils.

References

Accessed 2/13/19
https://www.kegworks.com/blog/keg-coupler-list/