INSTRUCTION MANUAL

FIZZIQ

COCKTAIL BOTTLING SYSTEM

INTRODUCING FIZZIQ

Congratulations!

You are among the very first owners of the FIZZIQ Cocktail Bottling System, a revolutionary new beverage product designed specifically for the hospitality industry. FIZZIQ is the first and only compact automated solution specifically designed for the production of bottled carbonated beverages—with FIZZIQ, you can batch, carbonate, and bottle virtually any amount of any beverage, and quickly and easily bottle dozens, hundreds, or thousands of bottles with extraordinary effervescence.

FIZZIQ is a new type of product, with a new way of doing things, so ***please read all instructions before attempting to install and use FIZZIQ.*** *A solid understanding of how the system works, along with a basic understanding of, for example, the science of carbonation, and how ice interacts with beverages, will help you to achieve consistently the results that you expect, with a minimum of effort. You will find these topics and many others of interest covered in this manual.*

Let's begin!

CONTENTS

Throughout this document you will see the following icons to bring certain elements to your attention:

= Required step

= Warnings

= Notes and cautions

= Tips and tricks

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Applies to serial numbers 011 and higher

CUSTOMER SUPPORT

For instructions and information about FIZZIQ, go to

support.AppliedFizzics.com

There you will find the most current information from us and our user base, including instruction manuals, videos, whitepapers, user forums, Wikis, and more.

To receive help with any aspect of this product, email us at

support@AppliedFizzics.com

You will get immediate priority assistance during the hours of 10 a.m. to 10 p.m., Pacific time. Other inquires will be answered by 10 a.m. the following morning.

SAFETY AND CARE PRECAUTIONS

Read this first!

- Only use FIZZIQ with approved, undamaged bottles.
- Only use FIZZIQ with the primary regulator provided. Do not attempt to adjust the pressure on this regulator. It is preset to a value that is calibrated to your machine.
- Do not attempt to use FIZZIQ without the safety door fully closed and locked.
- Do not attempt to use FIZZIQ if the machine has been damaged in any way.
- Make sure the CO_2 cylinder is firmly secured.
- Keep the door of FIZZIQ closed whenever possible, to reduce the chances of inadvertently damaging the door.

INSTALLATION AND SETUP

What's Included in the System

- Bottling machine
- Primary regulator
- Three braided pressure hoses
- Clear drain hose
- Conical seals for braided pressure hoses
- Power supply
- Replacement filling tube (clear plastic)
- Extra CO_2 tank seals
- Cleaning compound
- Wrench

You may also have ordered any of the following optional items:

- Carbonation vessel (Cornelius-style keg)
- Bottles
- Caps
- Capper
- Labels

Before You Begin...

You will need the following items for every bottling session:

- A CO_2 source, usually a 5 lb to 20 lb cylinder
- A method to secure the cylinder (e.g., a chain or rope, and some point of attachment to lash the cylinder upright)
- Cornelius-style keg for the carbonation vessel
- Approved bottles rated for high pressures (see below)
- Bottle caps and capper
- Ice
- Filter (if you are using fresh citrus or other ingredients that produce solid particulates, like mint leaves)
- Plug adaptor for U.S.-style plug (if outside the U.S.)
- Sink or dump bucket, bar towels

INSTALLATION AND SETUP

Suitable Bottles for FIZZIQ

Any bottle that is used for Champagne will work with FIZZIQ; any bottle not specifically designed for sparkling wines should be approached with caution. While the safety door eliminates any possibility of injury should a bottle explode during filling, there is the chance that a sub-standard bottle could rupture after it is taken out of the machine and capped, so it is vitally important to use the correct glassware.

***BOTTLES USED WITH THIS SYSTEM MUST BE CAPABLE OF WITHSTANDING HIGH PRESSURES**, such as those found in Champagnes and highly sparkling wines (~100 psi, with a 200% engineering safety margin).*

Bottles that are specifically designed for highly sparkling wines generally have a distinctive feature: there is a glass "collar" just below the lip of the bottle that is used to affix the wire cage (or *muselet*) that holds the cork in. If the bottle has this feature, and is significantly heavier than bottles of the same size, it may be designed for highly sparkling wines, and hence suitable for FIZZIQ.

Included with system is an example of a 187 ml bottle we have tested extensively. If you use bottles different from this, please consult with us beforehand.

Example of suitable 187 ml bottle for use with FIZZIQ. Note the "collar" just beneath the lip of the bottle.

Unpacking FIZZIQ

- Carefully unpack the bottling machine and other elements of kit.
- Set the FIZZIQ bottling machine on the level surface where it will be used.
- Remove any blue tape and protective film.

DO NOT DISCARD SHIPPING BOX, BLUE FOAM INSERTS, or any other packing materials! If service is required, you will need these materials to ship the unit back to us.

All units are wet-tested before shipping, and may show signs of moisture.

- Attach power cord to **POWER - 12V** jack. Plug end of power cord into power receptacle (120-240V, 50-60Hz). Press power On button (the power button is the circular black button below the control panel. When it is on, it will light up red.)

The transformer of the power source is rated for voltages in the range of 120-240V, 50-60Hz. You may need a plug adaptor in countries outside the U.S.

- Press "down" button (third from the right on the control panel) to open the door. Remove any foam or tape used to secure the platform during shipping. ***DO NOT DISCARD.***

Connect Hoses

- Check that there is a white conical seal in the end of each of the three fittings on the end of the braided hoses, with the more-pointed end inserted into the hose fitting (i.e., concave side facing out). ***These can easily fall out, so be careful to verify that the seals are present and properly oriented***.
- Attach the hoses in the following order, matching the colored band on the end of the hose with the color-keyed ring on the bulkhead:

RED = CO2 - SOURCE
BLACK = LIQUID - VESSEL
GRAY = CO2 - VESSEL

- Turn hose fittings with fingers till snug; then turn about one revolution further with the 9/16" wrench provided.

DO NOT OVERTIGHTEN! Over-tightening may damage the fittings. One-half to one revolution after snug should be fine—you can tighten more later if there are leaks.

- Attach clear drain hose by pushing the gray plastic fitting into the **EXHAUST** port on the bulkhead. The other end of the hose should be placed into a bucket, bottle, or sink to collect overflow.

You may trim this hose to any desired length.

Insert white seal in end of each of the three threaded hose fittings, pointed end facing inward.

Hoses and power cord attached to bulkhead

INSTALLATION AND SETUP

Connect CO_2 Source

- Attach FIZZIQ regulator to CO_2 cylinder by screwing the nut to the nozzle of the cylinder with a 1 - 1/4" wrench. Remove the blue restrainer from the nut and ensure the white seal is in place. Some regulators come with a black hand-tight wheel; to tighten, grasp the black wheel and tighten firmly, while rotating the entire regulator clockwise. Test by briefly opening the cylinder valve and turning off again. If no gas escapes, the regulator is on tight.

  You can use a 1 - 1/4" Crescent wrench or adjustable wrench to tighten the regulator with or without a hand-tight wheel.

  SECURE THE CO_2 TANK TO PREVENT IT FROM FALLING OVER! *Unsecured CO_2 cylinders are dangerous. You can use a chain or rope to secure the tank to a sturdy fixture; or there are many models readily available from industrial gas equipment purveyors. Here is a link to several types of cylinder attachments:* www.mcmaster.com/#cylinder-holders/

- Attach the red male quick-disconnect of **CO_2 - SOURCE** hose to red female disconnect of regulator. Pull back the outer sleeve of the female fitting while simultaneously pushing the male end in; then release outer sleeve.

- Now open the cylinder valve. Listen for escaping CO_2 at the bulkhead of the bottler. If you do hear a leak, try to identify which fitting it is coming from, turn off the CO_2 at the source, and slightly tighten the leaking fitting. Reopen the valve and check again. If you hear no leaks, you are ready for the next step.

Primary regulator attached to CO_2 cylinder, with quick disconnect fitting attached. Your regulator may or may not have a hand-tight wheel.

Power Up

- If not already powered up, turn on power to the machine by pressing the black button on the front of FIZZIQ. You may hear a buzzing sound for several seconds at bootup. The machine will then wake up and perform a power-up diagnostic check.

- FIZZIQ is now ready to use! You can open the door at any time by pressing **B3**.

OVERVIEW OF FIZZIQ

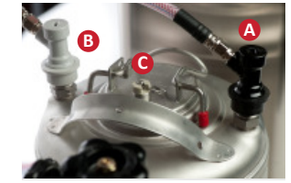
While it is not absolutely necessary to know how FIZZIQ works to effectively use it, we strongly recommend studying this section so you will have an idea of what is happening inside the machine. There is also a certain amount of tactile familiarity that you will develop as you use the system, which will make you faster and more confident the more you use it. Much like making a shot of espresso, it's not difficult—but it takes practice and a little knowledge to do it consistently and perfectly.

Here are the elements of the system that we will be referring to throughout these instructions:

FIZZIQ Bottling Machine

- **A** Control Panel
- **B** Bottle channel
- **C** Bottle platform
- **D** Safety door
- **E** Filling nozzle
- **F** Filling tube
- **G** Fill sensor

Nomenclature: *Collectively, the entire system may be alternately referred to in these instructions as FIZZIQ, CBS (Cocktail Bottling System), or the System. The Cornelius-style keg may be alternately referred to as the carbonation vessel, or simply the keg. The stainless steel bottling machine may be alternately referred to as the bottling machine, or the bottler.*



Carbonation Vessel

- **A** Liquid fitting
- **B** Gas fitting
- **C** Safety vent

OVERVIEW OF FIZZIQ

How FIZZIQ Works

FIZZIQ is a batch-carbonation and counter-pressure bottling system, which means that the batch-carbonated beverages produced by the system are bottled under the same pressure at which the beverage was carbonated. This minimizes foaming and loss of effervescence during the bottling process, allowing the quick and easy production of intensely carbonated bottled beverages with a minimum effort and mess.

The pressure inside the carbonation vessel, which is the pressure at which the beverage is carbonated and dispensed into the bottle, is determined by a secondary regulator within the machine. The pressure setting of this regulator is displayed on line 4 the screen in some contexts. (This value is factory-set to what we consider the optimal carbonation pressure at about 42.5 psi, but can be adjusted by the user. See section on **Calibration and Adjustment**).

The flow of liquid and CO_2 to and from the bottle and carbonation vessel is controlled by a number of valves inside the bottling machine, which are controlled by user input via buttons on the control panel and by a microprocessor within the bottler.

The basic principle is this: When you place a bottle in the machine and raise the platform, a gas-tight connection is made between the lip of the bottle and the white rubber filling nozzle. When the safety door is closed, the pressurization sequence is automatically initiated, which brings the bottle to the same pressure as the carbonation vessel. When the bottle is fully pressurized, the controller opens the valve that controls the flow of liquid into the bottle. Liquid will not flow into the bottle, however, until some amount of gas is allowed to flow out of the bottle, since the carbonation vessel and the bottle are at the same pressure. So, when the liquid-in valve opens, the controller simultaneously opens the gas-out valve to allow gas to exit the bottle and allow liquid to flow in.

The gas-out pathway from the bottle passes through an adjustable needle valve, which controls the exhaust rate of gas from the bottle—which in turn controls the rate of liquid flowing into the bottle during filling. The adjustment knob for the needle valve is on the control panel: turning it counter-clockwise opens the valve and increases the rate of flow; clockwise decreases the rate of flow. Think of this knob as the speed control for filling and depressurizing the bottle.

The CO_2 vented from the bottle exits the back of the machine via the tube connected to the **EXHAUST** port in the back of the machine. (During the cleaning process, this gas pathway is back-flushed with water.) You can hear and see the bubbling of escaping of gas if you put the end of the exhaust tube in a container of water.

FIZZIQ User Interface

The primary user interface for FIZZIQ is the control panel on the front left panel of the bottling machine. The control panel has a screen, three capacitive touch-buttons, and a flow-speed control knob.

FIZZIQ Control Panel showing the screen, B1 (up), B2 (fill), B3 (down), and the Fill/Exhaust knob.

Touch Buttons

The three buttons on the panel are labeled UP, FILL, and DOWN, but actually perform different functions depending on the context. In these instructions, the buttons will also be referred to, from left to right, as **B1**, **B2**, and **B3**. In some contexts, a button may require a continuous touch to be ON; in other contexts, the buttons act as toggle switches, with one touch turning them to the ON state, and the next touch turning it to the OFF state. In either mode (continuous press or toggle), when a button is activated, i.e., ON, it is lit up; when OFF, it is not lit. Here are the functions of the buttons in various contexts:

*UP Button (**B1**)*

If the door is open and the platform is not locked in the UP position, **B1** raises the platform.

*FILL Button (**B2**)*

- If a bottle is in place, and the platform is locked in the UP position, and the door is closed, **B2** toggles the flow of gas into the bottle to pressurize it.
- If the bottle is fully pressurized and filling with liquid, **B2** toggles the flow of liquid into the bottle. Again, anytime the button is lit up it is ON; touching the button again will toggle it OFF.

*DOWN Button (**B3**)*

- If the door is closed and there is a pressurized bottle in place, **B3** toggles the exhaust of gas out of the bottle, thus decreasing the pressure in the bottle. When the button is ON, gas is allowed to exit the bottle; touching the button again will toggle it OFF, halting the flow of gas. Again, when the button is ON, it is lit.
- If there is no bottle in place or there is a fully depressurized bottle in place, and the door is closed, **B3** opens the door.
- If the door is open and the platform is up, **B3** lowers the platform.

Screen

- Lines 1 and 2 of the screen always give context-sensitive instructions, telling you what you are allowed to do next given the context (e.g., “Insert bottle…”, or “**B2** toggles filling”). This is where you should look to know what you should do next.
- Line 3 gives current status of the system (e.g., “Ready…”, or “Filling…”)
- Line 4 gives current pressure data of the regulator, the bottle, or both, depending on context.

***Fill/Exhaust** Knob*

At the bottom of the control panel is a knob which adjusts an internal needle valve, which controls the rate at which gas is allowed to exit the bottle. In the filling mode, the rate at which gas exits the bottle determines the fill rate; in the depressurization mode, the exhaust rate determines how fast the bottle depressurizes. Think of this as the speed control for the machine.

The knob has a red locking ring which must be pressed IN so the knob will turn.

Button Combinations

There are combinations of buttons that can invoke special features in certain contexts:

*In these instructions, button combinations are denoted as, for example, **B2 +** B1. This means first press **B2** and continue to hold it, and then also press **B1**.*

*Purging (**B2 + B1**)*

With the platform down and the door open, pressing and holding **B2** and then pressing **B1** causes a burst of gas to flow. If you hold the lip of the bottle just below the filling head, a 1-2 second burst of CO_2 will purge the bottle of most of the air inside. Use this if you wish to achieve maximum shelf life of your bottled beverages, especially those with fresh juices. (This function also helps purge the gas pathways of liquid after the cleaning cycle.)

*Menu (**B2 + B3**)*

Pressing and holding **B2** and then pressing **B3** will invoke the menu. The menu is discussed in detail below.

The FIZZIQ Menu

FIZZIQ features a menu system that allows you to access several key functions and adjustments. Press **B2** and hold and then simultaneously press **B3** to enter the menu (**B2 + B3**). In the menu, you will find these options; follow the on-screen instructions to navigate among them:

- Set Autosiphon
- Cleaning Mode
- Carbonation Mode
- Manual Mode

These are described in detail on the following pages.

Set Autosiphon

When the fill sensor is tripped during filling, the system will automatically attempt to evacuate liquid out of the bottle down to the bottom of the filling tube. The system accomplishes this with a timed automatic siphon process, the duration of which can be set by the user. Ideally, the autosiphon duration should be set so that the liquid withdraws down to the bottom of the filling tube, and then continues for a fraction of a second longer to draw the liquid back up the filling tube just enough so that it doesn't drip when the bottle is removed.

A too-short autosiphon timer duration may not allow enough time for the liquid to be evacuated all the way to the bottom of the tube (which is not necessarily a big deal, but will lead to dripping). A too-long autosiphon duration will evacuate liquid down to the bottom of the filling tube, but then continue to draw liquid out of the beverage line and push it back into the keg; so when the next bottle is filled, the beverage will have to re-fill the liquid line before it even reaches the filling head to begin filling the bottle. This wastes time and creates excessive turbulence that may lead to greater foaming in the depressurization process.

This optimal autosiphon duration will depend primarily on these variables:

- **Location of carbonation vessel:** FIZZIQ is designed to be used with the keg on the floor, lower than the machine. If the carbonation vessel is on the same work surface as the machine, the autosiphon process will be slower since it is not being assisted by gravity, and you may need to adjust the autosiphon duration upwards.
- **Viscosity of liquid:** The more viscous the liquid, the slower the autosiphon process. Viscous liquids may require a longer autosiphon duration. The same would be true if there were a temporary, partial blockage of the liquid line, due to pulp or ice.

Setting the AutoSIphon Value

From the first screen of the Menu, press **B1** to go to the Set Autosiphon screen. From the Set Autosiphon screen, press **B1** to increase the duration in 0.1 second increments; press **B2** to decrease the duration in 0.1 second increments. The current value of the autosiphon duration will be shown on line 4 of the screen. Press **B3** to save the new value to permanent memory and exit. When you next use the machine, this value will be preserved, and will be displayed on the screen during startup.

Under most circumstances, autosiphon duration values around 1.5 to 2.5 seconds seem to work best.

Cleaning Mode

Pressing **B2** on the first screen of the Menu takes you to the cleaning mode option. In cleaning mode, the fill sensor is disabled, allowing you to back flush cleaning liquids through the machine without tripping the fill sensor. From the Cleaning Mode screen, press **B1** again to enter cleaning mode. In cleaning mode, line 3 of the screen will display the status message "IN CLEANING MODE" to remind you that the fill sensor is disabled.

When done cleaning, navigate back the Cleaning Mode screen and Press **B3** to exit Cleaning Mode (or simply power down the machine—it will not wake up in Cleaning Mode during next use).

Carbonation Mode

Carbonation Mode is essentially a coaching tool that helps you get consistent and effective carbonation results by giving you feedback on how hard you are shaking the keg, and how much time has elapsed. From the first screen of the Menu, press **B3** to go to screen 2, then press **B1** to enter the Carbonation Mode.

When you are at the Carbonation Mode screen, and you are ready to begin carbonation, press **B1** to initiate the carbonation sequence. The on-screen instructions on Line 3 will coach you through eight 15 second agitation periods ("SHAKE…") and eight 15 second rest periods ("REST…").

OVERVIEW OF FIZZIQ

There is a number on Line 4 at the bottom of the screen during the carbonation process that represents how hard you are agitating the keg as a percentage of a minimum threshold. The goal is to keep this number over 100. This number is a measure of how fast CO_2 is dissolving into the beverage: the larger the number, the faster CO_2 is dissolving into the keg.

When you are shaking the keg hard enough to exceed the minimum target, you will hear a beeping sound, and a message on Line 3 that indicates the target has been met. That is what you are striving for—if you hear the beeping sound and see the message, you are shaking the keg sufficiently hard to achieve the desired uptake of CO_2 in the allotted time. (If you are no longer able to reach the 100% target rate, the liquid is close to saturation, and you may elect to stop the carbonation cycle early).

In four minutes or less, the liquid will be completely saturated with CO_2 at the pressure setting of the secondary regulator. The controller will exit Carbonation Mode automatically after four minutes; or you can press **B3** to exit Carbonation Mode anytime.

Manual Mode

THIS MODE SHOULD ONLY BE USED FOR TROUBLESHOOTING UNDER SPECIFIC INSTRUCTIONS FROM THE MANUFACTURER.

In this mode, you are able to control the function of each solenoid individually, which is useful for some diagnostic operations. From the initial menu screen, press B3 for More... then B2 to invoke Manual Mode. Press B1 to start Manual Mode.

Pressing B1 + B2 (instead of just B1) to start Manual Mode will initiate an undocumented diagnostic mode in which all of the normal safeguards are disabled. In particular, ***in this mode it is possible to dispense liquid under pressure when no bottle is present***. This is not possible in normal operation, or even normal Manual Mode operation, where there is a safety interlock to prevent the flow of beverage unless there is a pressurized bottle in place and the door is closed. ***THIS MODE SHOULD NOT BE USED EXCEPT UNDER DIRECT SUPERVISION FROM THE MANUFACTURER.***

BATCHING THE BEVERAGE

The first step in any FIZZIQ bottling session is to batch the beverage. Batching a beverage for use with FIZZIQ is not substantially different from batching a beverage for a non-carbonated application. Simply batch the beverage in a clean container as you normally would, and transfer it to the carbonation vessel when ready to begin. There are a few additional considerations for carbonated bottled beverages, however:

Carbonic Acid

First, some of the CO_2 that dissolves in solution creates carbonic acid, a neutral-tasting acid that increases the tartness of the beverage once carbonated. You may need to account for this in your recipes, by making the initial batch very slightly sweeter than you would for the same recipe uncarbonated. This extra acidity can also interact with other flavor components in unexpected ways, especially in spirit-forward recipes that don't include citrus juices or other sources of acidity, and in particular with wood-aged spirits. Learning how to compensate for this takes time and experience. The Perlini Cocktail Shaker, which is interoperable with FIZZIQ, is a great way to test the effects of carbonation in small volumes before committing to an entire batch.

Particulates

Pulp or other solid particulates in the batch (e.g., mint leaves, fruit pulp) also have a different effect in carbonated vs. uncarbonated beverages, as they provide "nucleation sites" where bubbles can form. This can lead to excessive foaming at bottling time, and to a lesser extent when the beverage is poured from the bottle into a glass. We recommend filtering the ingredients that contain solid particulates before batching. A mesh filter bag works well for this.

Other types of clarification methods can be used to create an even clearer beverage, such as finings or centrifuging, but this is not required for use with FIZZIQ.

Dilution

Effective carbonation requires ice-cold temperatures for the liquid

ingredients, and the recommended method for attaining low temperatures is the addition of ice during the carbonation process.

As we will show in more detail in the section on Ice Melt and Dilution in **ADVANCED TOPICS**, there will be approximately 300 milliliters (or 300 grams) of dilution from ice melt for every liter of liquid of room-temperature ingredients used in the batch, or about 10 ounces per quart. This assumes that you start with at least 300 grams of ice per liter to begin with—because you can't have more dilution from ice melt that you have ice, right?—and that the resulting ice/liquid mixture is at equilibrium at ~32° F/0° C). In summary:

Dilution Rate from Ice Melt
300 ml / liter, or 10 oz / quart

For example, if you have a recipe that calls for 4 quarts, or 128 ounces, of alcohol and mixers, you can expect about 4 quarts x 10 oz/quart = 40 oz of additional water from ice melt. Since there are 32 ounces per quart, your final bottled volume will be about 5 quarts, 8 ounces.

We recommend adding significantly more ice than this, so that there will be ice left over in the keg after the liquid has come to equilibrium at 32° F. Though it may seem counter intuitive, adding more ice will not cause additional dilution—in fact, over a short time span, it will actually create less dilution! This is because any extra ice beyond what is required to chill the liquid to 32° F may actually cause freezing of water in the mixture, creating ice where there was none.

Over the normal time span it takes to bottle a keg, there will not be enough heat transfer from the outside environment into the keg to cause appreciable additional ice melt; so, as a general rule, you basically cannot add too much ice—there is no downside to adding more ice than necessary to completely chill the ingredients to 32° F (aside from the expense of the ice). However, if you are bottling in a very hot environment, or expect the bottling process to take a longer than usual time, due perhaps to an interruption, you can put the keg in a tub of ice to minimize additional ice melt.

Basic Principles

The amount of CO_2 that will dissolve in liquid is extremely temperature dependent. The colder the liquid, the more CO_2 will dissolve and the more carbonated the drink will be, so it is important that the mixture you are bottling is as cold as possible (assuming you want vigorous carbonation). Refrigerator temperature (~40° F) is good; 32° F is better. This eight degree temperature difference makes about a 20% difference in the absorption of CO_2. Ice-cold water will absorb 2.5 times more CO_2 than room temperature water!

Once you have batched the cocktail, you could pre-chill the entire mixture in a refrigerator to lower the temperature, but this would take many hours. The easiest, best, and fastest method is to start with unchilled ingredients, and then pour the batch over ice in the keg, with sufficient ice to chill the mixture all the way to 32° F. This method has the advantage of consistency, since the liquid-ice mixture will always be near 32° F (the equilibrium temperature for a water-ice mixture; slightly below this for an alcohol-water-ice mixture), and the amount of dilution is easy to calculate. And, further, it takes minutes instead of hours.

The goal is to use at least enough ice to completely chill the liquid ingredients to 32° F. This takes approximately 300 grams of ice for every liter of room-temperature liquid ingredients, or about a half pound of ice per every quart. Adding this amount of ice will be just sufficient to cool the liquid to 32° F—but with all of the ice melted when 32° F is reached.

We have found that the type of ice used makes little or no difference to the final product, as long as the ice has no off flavors, and is as cold as possible. Ice melts at 32° F, of course; but it can be any temperature below this. It will generally be the same temperature as the freezer that it came out of; so the colder, the better.

See the section on Carbonation in **ADVANCED TOPICS** for more detailed information.

Carbonating the Beverage

We recommend practicing the carbonation and bottling process with plain water first to get an idea of how the FIZZIQ system works.

- Batch the beverage in a clean vessel.

  Filter any ingredients that have pulp or other suspended solids. Filtering reduces the number of nucleation sites where bubbles can form, which reduces foaming during bottling. It will also reduce the chance of blockages in the system. Use a 5 micron filter bag (or whatever else you are comfortable with).

- Add ice to the carbonation vessel. Assuming you start with cold ice at about 0° F (typical freezer temperature) and room temperature ingredients, this will take a minimum of 0.6 pound of ice per quart of liquid.

  As a simple rule-of-thumb guide, add about as much ice by volume as there is liquid. For example, if you intend to fill the keg half full with beverage, fill the keg about half full with ice first before adding the liquids; then fill the keg with beverage up to the half-way point.

- Add the beverage to the carbonation vessel

  DO NOT FILL CARBONATION VESSEL MORE THAN 4/5 FULL. *It will take longer to carbonate, because vigorous splashing will be inhibited by the lack of headspace.*

  You can test the amount of dilution by sampling the batch after it comes to equilibrium on the ice, before closing the keg for carbonation. Stir the mixture on ice with a long-handled spoon for 20-30 seconds and then sample; if you want more dilution, you can add water. If you want less dilution, well, that's a problem at this point—so it is better to shoot for under-dilution in your recipes.

- Close top of keg. Make sure safety release valve is closed.

- Attach the GRAY quick-disconnect fitting to the IN fitting of the keg. Simply press it down firmly until it clicks. You should immediately hear gas flowing to keg.

  CONNECTING THE FITTINGS ON THE KEG INCORRECTLY WILL RUIN THE MACHINE, AND VOID THE WARRANTY. The GRAY quick disconnect MUST connect to the IN fitting of the keg, and the BLACK disconnect MUST connect to the OUT fitting on the keg. If these are backwards, liquid will be forced into the gas passageways of the machine, which could ruin the secondary regulator and the pneumatic lift that raises and lowers the platform. The liquid and gas fittings on the keg are of slightly different shape to eliminate the chance of connecting the keg the wrong way—but it is possible to connect them incorrectly with enough force, so please use caution, and do not use excessive force when attaching the keg fittings.

- Enter the Menu Mode by pressing **B2 + B3**. Choose Carbonation Mode.

- Lay the keg across your lap horizontally. Use a towel across your lap to absorb condensation if you wish.

  BE CAREFUL NOT PULL THE MACHINE OFF THE COUNTER BY PULLING ON THE HOSE!

- Press **B1** to initiate the carbonation sequence. When the on-screen instructions on line three say "SHAKE…", begin shaking the keg vigorously forward and back on your lap. You must shake the keg hard enough to create vigorous splashing: the splashing greatly increases the area of the liquid-gas interface, which can increase the rate of CO_2 absorption by a factor of thousands. This allows you to force carbonate a batch of beverage in a couple minutes instead of many hours--but this only works if the agitation is vigorous.

CARBONATING THE BEVERAGE

- In Carbonation Mode, there are two numbers on the bottom of the screen: On the left is a number that measures the dip in regulator pressure as gas dissolves in the liquid. This is a measure of how fast CO_2 is dissolving in the beverage. On the lower right of the screen is a target number that you are trying to exceed, which is 100%. When you are shaking the keg hard enough to cause a pressure dip that exceeds the target, you will hear a beeping sound. That is what you are shooting for—if you hear the beeping, you are shaking the keg hard enough.

  You must shake the keg hard enough to cause vigorous splashing inside the keg. It is this splashing that causes rapid uptake of CO_2, by vastly increasing the area of the liquid-gas interface.

  If you place the keg on your lap and turn it so that the gray Gas-In fitting is downward, you should be able to hear CO_2 bubbling into the keg during rest periods. The rate of bubbling gives you an indication as to how fast CO_2 is being absorbed.

- Pause when the screen says “REST...” Follow the on-screen instructions which include intermittent 15 second intervals of shaking and resting periods. After four minutes (eight 15 second cycles of shaking and resting), the beverage should be completely saturated with CO_2.

  If you are unable to keep the rate above 100%, you may already be at saturation and can stop.

- Exit the carbonation mode by pressing **B3**.

- Set the keg on the floor, and let sit for a couple minutes to allow the bubbles from agitation to subside. You may put the keg on ice if you desire, but this is generally not required unless you anticipate an interruption or delay in the bottling process.

  We recommend setting the keg on the floor, below the bottling machine; but it may also be set on the same work surface as the machine. (See the Menu section on setting the autosiphon duration for a discussion of the implications of this choice.)

BOTTLING

Now we get to the fun part: getting the beverage into the bottle. Make sure you have your chilled, wetted bottles prepared in advance, and you caps and capper handy.

To minimize foaming during the bottling process, and thus maximize carbonation levels, keep the empty bottles partially submerged in a tub of ice water prior to bottling, or wetted and in a refrigerator. The cold water will lower the temperature of the bottle and wet the nucleation sites, both of which will reduce the amount of foaming during depressurization (see section on the Science of Carbonation).

- Turn **Fill/Exhaust** knob lightly all the way clockwise. (There is a red locking ring on the knob; make sure it is pushed in to allow the knob to turn. You should never have to use the locking ring; but be aware that if you can’t turn the knob, that may be why).

- Press **B3** to open the door.

- Insert bottle on nozzle. You do not need to push it on hard, but be careful to get it properly aligned by ensuring that the lip of the white nozzle is not “snagged” on the lip of the bottle. A good way to do this is the give the bottle a little twist while you gently push up against the filling nozzle. Hold the bottle there with your right hand.

- Press and hold **B1** button to raise the platform. Hold the button until you here a beep and the screen says “Ready…”.

- Make sure bottle is vertical and sitting squarely on platform.

  You may wish to place a folded paper towel on the platform to absorb drips. Also, bottom of the bottle can mar the stainless platform, and a paper towel will prevent this.

- Close the door. The closing of the door will automatically start the bottle pressurization process.

- When the bottle is fully pressurized (a fraction of a second for small bottles; about a second for a 750 ml bottle), filling will automatically begin.

Bottle properly installed on Filling Nozzle. Take care that the white lip of the filling nozzle is not snagged on the lip of the bottle.

BOTTLING

- Adjust fill rate by turning the **Fill/Exhaust** knob COUNTERCLOCKWISE to increase fill rate, and CLOCKWISE to reduce. Fill the bottle slowly at first until you get a sense for how fast you can fill.

  The faster you fill the bottle, the more agitation there is, and the more foaming you will have during the depressurization phase, and the longer it will take to depressurize the bottle. There is a trade-off between faster filling and slower depressurization.

  *If you try to fill the bottle too quickly, the system will automatically temporarily halt the filling process and repressurize the bottle. You will need to turn the **Fill/Exhaust** knob clockwise to reduce the fill rate, and then press **B2** to resume filling.*

Bottle filled almost all the way to Fill Sensor

- When the liquid reaches the fill level sensor at the top of the bottle, filling will automatically stop, and the system will automatically adjust the liquid level to the bottom of the clear filling tube. Depressurization will then automatically begin.

- As the bottle depressurizes, dissolved CO_2 will attempt to escape, creating foaming. If the liquid foams up and the foam billows up to the top of the bottle, the fill sensor will detect the presence of the foam, and immediately repressurize the bottle to tamp the foam down. After a brief pause, depressurization will resume automatically. You can monitor the pressure of the bottle by looking at the number in the lower right of the screen. All pressure readings are in psi (pounds per square inch).

- When the bottle reaches atmospheric pressure (actually, about 3 psi above atmospheric pressure), the door will open and the platform will drop several inches. Remove the bottle.

  Many bottles will stick to the nozzle momentarily and then drop off, so you need to be ready to reach in when the door opens and grab the bottle before it falls off and spills. Gently remove the bottle with a little twist while pulling downward.

- Insert the next bottle, close the door, and repeat the process.

- Cap the bottle you just filled while the next bottle is filling.

  The foam sensor will sometimes not be activated if the foam is very sparse. When this happens, a small amount of liquid may enter the gas pathway that passes through the needle valve. The liquid will tend to block the orifice of the needle valve, because liquid is much denser and more viscous than gas. This will slow or halt the depressurization process. To fix this, open the needle valve by turning the fill knob counterclockwise a significant amount more, maybe an entire revolution or two. This will open the valve further and blow out the liquid from the valve, so normal depressurization can resume. REMEMBER TO IMMEDIATELY TURN THE FILL KNOB BACK DOWN TO A SUITABLE FILL RATE BEFORE ATTEMPTING TO FILL THE NEXT BOTTLE, or you will end up filling it too fast, creating excess turbulence and hence excess foam during depressurization.

- You will know when you are at the end of the keg when the filling of the bottle sputters, much like coming to the end of the keg with a draft beer system. Press **B2** OFF, and press **B3** to depressurize.

  *FIZZIQ contains a microprocessor, and like any computer, it can sometimes get in a state where the only recourse is to reboot it. If you're at a point where you don't understand what is happening, quickly cycle the power. The machine will reboot, and in the bootup process it will safely reset itself. For example, if there is a pressurized bottle "stuck" in the bottler when you cycle the power, FIZZIQ will safely vent the bottle, open the door, and drop the platform. Remove the bottle, close the door, and press **B1** to continue the initialization process. Then reinsert the bottle and try again.*

  Never leave the bottling machine in the power-off state with a pressurized bottle in place. The machine needs to be ON for the microprocessor to recover from situations like this.

BOTTLING

Manual Operation

- Any time the bottle is filling, pressing **B2** will toggle the filling process OFF. Pressing **B2** again toggles **B2** back ON. You can potentially save several seconds per filling cycle by not waiting for the liquid to fill all the way to the fill sensor by stopping the filling manually.
- To begin depressurizing after stopping the filling process manually, you must manually press **B3**, which toggles **B3** ON. You can pause the depressurization process by pressing **B3** again, which toggles **B3** OFF.

  __B2__ and __B3__ are lit up when ON; that is, when the __B2__ is lit up, bottle is filling; When __B3__ is lit up, the bottle is venting. Pressing __B2__ or __B3__ when lit will toggle the button to OFF; pressing them again will toggle them back ON.

- ***Shortcut to Depressurizing:*** You can manually stop filling and start depressurizing with single **B3** button push anytime during filling.
- ***Foam Tamping:*** During depressurization, you can tamp down the foam manually before it hits the fill sensor by pressing **B2**. This will emit a short burst of gas to tamp down the foam. By manually stopping the filling process before the liquid hits the fill sensor, and manually tamping the foam before it hits the fill sensor, you may be able to achieve slightly faster filling cycles.
- ***Fill Sensor Override:*** You can override the foam sensor in the depressurization routine by pressing and holding **B1**. With **B1** pressed, liquid will be pushed through the machine and out the Exhaust port in the back.
- ***Overfill Adjustment:*** You can now adjust an overfill after manually stopping the filling process. Simply press and hold **B1** when filling has been toggled off, and liquid will siphon from the bottle back to the keg until the liquid level reaches the end of the clear filling tube.
- ***Menu Shortcut:*** You can get to the menu by pressing and holding **B1** during bootup.

CLEANING THE SYSTEM

It is absolutely imperative that the bottling system be flushed thoroughly after each use. Failure to do so may result in residue from the beverage drying and sealing shut the solenoid valves that control the flow of liquid, which will render the machine inoperable.

To clean the system, follow these steps carefully and in order.

Cleaning

- Remove the gas and liquid fittings from the carbonation vessel.
- Depressurize the vessel by pulling the ring on the safety release valve on the keg. When the keg is completely depressurized, remove the lid.
- Rinse keg thoroughly with clean water.
- Put one gallon of clean, hot tap water in the keg, and add one ounce of Five Star PBW Cleaner (or equivalent). Swirl the water vigorously in the keg to mix the cleaner.

  You do not have to use the cleaner every time you use the system. Every 3-4 uses should be fine with typical cocktail recipes.

- Close the keg, and re-attach the liquid and gas fittings to the keg. The keg will begin to pressurize.
- Make sure the free end of the clear exhaust tube is placed in bottle, bucket, or sink.
- Press **B2 + B3** to enter the Menu mode.
- Choose Option 1, Cleaning Mode. Cleaning mode deactivates the fill sensor, allowing the machine to be back-flushed with water.
- Place a 187 ml (included with system) bottle on the filling head, raise the platform, and fill the bottle as you normally would. Stop the filling manually when full, and depressurize. Discard the contents of this first bottle, which will remove the majority of any pulp or other sediment that was left in the liquid line.
- Now fill the bottle again, but this time do not stop the filling

process when the liquid reaches the top of the bottle. In cleaning mode, the liquid will not stop at the fill sensor, but instead will overfill the bottle and be forced into the gas passageways, cleaning any beverage residue left behind.

Because liquid is more dense and viscous than gas, you will need to open the needle valve wider for water than for gas. Turn the fill knob counterclockwise until the cleaning solution comes out the back of the machine through the clear exhaust tube at a rate such that the process of emptying the gallon of cleaning liquid from keg takes 10-20 minutes. As with the normal filling process, the machine will self-limit how fast you can make the liquid flow.

- When the liquid in the keg is gone, press **B2** to stop the filling process, and press **B3** to depressurize. Remove the bottle and empty the contents.

Rinsing

- Repeat this procedure with two quarts of clean, hot water to rinse the system. Empty the contents of the last bottle when the keg runs dry.

Drying the System

- Tilt the keg or turn the keg on its side so that the dip tube cannot reach any residual water left in the bottom of the keg.
- Place an empty bottle in the machine and attempt to fill it in the normal fashion for about 60 seconds. This will remove the last few drops of remaining water from the liquid line and dry it out.
- Press **B2** to stop the attempted filling, and **B3** to depressurize. Remove the bottle.
- Finally, execute the purge function by pressing **B2 + B1**. This will release a short blast of gas that will remove any remaining water from the gas tube in the filling head.

Final Cleanup

- Wipe the machine off with a clean damp cloth. Pay particular attention to wiping up any beverage residue in the platform channel, especially the “ceiling” of the channel. Raise the platform to access the lower part of the channel to wipe it down.
- Lower the platform and close the door.
- Power the unit down and unplug from power source.
- Disconnect the quick connect fitting from the keg.
- Depressurize the keg by pulling up on the safety release ring.
- You may leave the system in this state until the next bottling. If you need to break down the machine for storage or travel, go to the next section.

Always turn off the gas at the cylinder when not in use.

DISASSEMBLY AND STORAGE

Follow these steps in the precise order if you need to disassemble FIZZIQ after cleaning, perhaps for transportation or storage.

- Lower platform and close door.
- Remove power cord and exhaust hose.
- Close the cylinder gas valve.
- Disconnect the gas line from the regulator at the red quick disconnect.
- Depressurize keg by pulling up ring in safety valve on top of keg. Remove lid when fully depressurized.
- Detach hoses from the back of the machine using 7/16” wrench. Remove in reverse order to that in which they were attached: Gray, Black, then Red.
- NOW Detach the gas and the liquid fittings from keg.
- Place a piece of masking tape over the ends of the hoses to make sure that you don’t lose the white conical seals.
- Store hoses in a plastic bag.
- Remove regulator from tank and store in box provided.

CALIBRATION AND ADJUSTMENTS

Door Tensioner Spring

The door has a spring that provides friction to dampen the opening motion. If the door is opening too slowly, or not all the way, you can reduce the tension of this spring; likewise, if the door is opening too fast and bouncing at the end of its travel, you can increase the tension.

The adjustment for the tensioner spring is found under the right front foot of the machine. CAREFULLY slide the machine so the right front foot is hanging over the edge of the counter. BE CAREFUL TO SECURE THE MACHINE SO IT DOESN’T FALL. There is a Phillips head screw at the bottom of a hole in foot; turn it clockwise to increase the tension on the spring; counterclockwise to reduce the tension.

Autosiphon Value

When filling automatically, the bottle will stop filling when the liquid touches the fill sensor, and then siphon back down. This is controlled by a timing process. Refer to the Menu section for a description of how to set this value.

Filling Tube Length

The length of the clear plastic filling tube can be changed if you desire, to get different fill levels. In particular, if you are using 750 ml bottles, you may want a longer filling tube. A length of clear plastic tubing is provided for this purpose. Cut to the desired length, and slip over the end of the stainless steel tube.

The tubing is a very tight fit, and it is fairly difficult to get the plastic tubing over the end of the steel tube. We recommend dipping the tube in very hot water to soften it, and quickly inserting the pointy jaws of a pair of small needle-nose pliers inside the end of the tube, and forcing open the pliers. This will stretch the tubing. Quickly force the end of the plastic tubing over the filling head tube before it has time to relax back to its original diameter.

CALIBRATION AND ADJUSTMENTS

Adjusting the Carbonation Pressure (Advanced)

This is an advanced adjustment that requires removing the back of the machine, and should only be done in consultation with the manufacturer. FAILURE TO CONSULT CUSTOMER SERVICE BEFORE UNDERTAKING THIS ADJUSTMENT WILL VOID THE WARRANTY.

- Unplug the machine from the power source.
- Remove the back of the machine by removing the six hex screws, and pull the back away from the machine so you can access the inside. There is no need to remove the hoses; indeed, they must be attached to make this adjustment, and the CO_2 source must be attached and the cylinder valve open.
- The regulator is inside the machine resting on the bottom plate. The adjustment knob points to the right. The knob is locked for shipping; pull the knob out (to the right) to unlock it. Turn it clockwise to increase the pressure; counter clockwise to decrease. There is a gauge on top of the regulator that shows the pressure. Push the knob back in to lock it when you are finished.

  The internal regulator can be adjusted as high as 60 psi, but we STRONGLY recommend against using pressures above 45 psi. There is simply no point in carbonating a liquid significantly past its saturation point at atmospheric pressure. True, by turning up the regulator, you can dissolve more CO_2 into solution (this is a linear relationship; e.g., doubling the pressure results in double the dissolved CO_2). However, remember that you have to get the bottle back to atmospheric pressure to cap it—and when you do, CO_2 will billow out of solution as foam until it reaches its effective saturation point at atmospheric pressure.

  We have found carbonation pressures in the range 37.5 psi–42.5 psi to be optimal for the vast majority of beverages. If you want a more lightly carbonated beverage, or are trying to bottle a beverage that is particularly prone to foaming, you may wish to adjust the regulator downward. Liquids that are viscous, or have some protein or fat content like dairy, and some bitters and herbaceous bitter alcohols, are particularly prone to foaming and may require lower pressures.

  The regulator is easy to adjust upwards in pressure, because the gauge will show you in real time what the new pressure is. However, if you are adjusting it downward, the gauge will continue to register the previous pressure because the gas is trapped in the lines. To release the pressure in the lines so the regulator gauge will read the new pressure setting, briefly push the gray GAS - IN keg fitting onto the IN fixture of the open keg. This will open the shutoff valve in the quick-disconnect fitting, and let the trapped gas out. Then the regulator will allow gas to repressurize the line up the new setting, which you can then reliably read on the gauge.

MAINTENANCE

There are no user-accessible maintenance requirements specified at this time, beyond the cleaning protocols described above.

TROUBLESHOOTING

ISSUE: Liquid won't flow when bottle in place and B2 is ON.

- Check to make sure black liquid fitting is properly attached to keg.
- Check to make sure that the **Fill/Exhaust** knob is open. It could be blocked by liquid; open it a full revolution or two to the left, then quickly turn it back down to a suitable value.

ISSUE: Repeated "Filling too fast" error, but little or no liquid is flowing into the bottle.

- See above. Check to make sure black liquid fitting is properly attached to keg.
- It is possible that a blockage has developed somewhere between the dip tube in the keg and the Filling nozzle. This can be cleared in Manual Mode by backflushing the liquid line with CO_2, but is beyond the scope of these instructions. Please contact us at support@appliedfizzics.com

ISSUE: Bottle won't depressurize when B3 is ON.

- Check to make sure that the **Fill/Exhaust** knob is open. It could be blocked by liquid; open it a full revolution or two, then quickly turn it back down to a suitable value.

ISSUE: Machine seems to be stuck, or no buttons seem to be active.

- Re-boot the machine by turning it OFF and quickly ON again. If there is a pressurized bottle stuck in the machine, the machine will detect it and immediately depressurize it during boot-up. You will see the bottle pressure displayed on the lower right of the screen; if the pressure is high and not falling, open the **Fill/Exhaust** knob more.

WARNING AND ERROR MESSAGES

MESSAGE: "Filling too fast—Close exhaust valve"

If you try to fill the bottle too fast (i.e., the pressure difference between the keg and the bottle is too great), the controller will automatically halt filling to prevent excessive turbulence and foaming. Turn **Fill/Exhaust** knob clockwise to turn down flow rate, and press **B2** to resume.

MESSAGE: "Input pressure drop. Check tank and hoses"

If you begin to run out of CO_2 during the filling process, the machine will warn you that the pressure has dropped since the start of the filling session. You should change CO_2 cylinders and resume bottling.

The system relies on a specific gas pressure to push the platform up with sufficient force to create a seal between the bottle and filling nozzle, and thus will not allow you to continue if the cylinder is running out of gas. You should always have a second full CO_2 tank on hand when bottling.

MESSAGE: "Gas off or empty. Check tank & hoses."

This message will occur at startup if the CO_2 source is not connected, the main valve is not opened, or the CO_2 tank pressure is low or the tank is empty.

MESSAGE: "Pressurized bottle found; open vent to depressurize bottle"

If you have to cycle the power when there is a pressurized bottle in place, the System will detect it and attempt to vent the bottle. If you do not see the bottle pressure dropping on screen, open the **Fill/Exhaust** knob further. Just remember to turn it back counterclockwise before filling the next bottle.

WARNING AND ERROR MESSAGES

MESSAGE: "Platform locked"

This is related to the message above. If the system detects too-low input pressure, it will close the solenoid that provides gas pressure to hold the platform up in an attempt to trap gas pressure in the pneumatic cylinder and keep the platform in the fully raised position. Otherwise, low input pressure could cause the platform to drop slightly with a pressurized bottle in place, which could lead to a rapid depressurization of the bottle and a loud report.

MESSAGE: "No bottle, or leak"

If you close the door with the platform up and no bottle in place, the system will begin to try to pressurize the absent bottle. The controller will quickly determine that no bottle is present, and stop the flow of gas. This can also happen if there is a bottle in place, but it is incorrectly placed on the Filling nozzle and leaking.

MESSAGE: "Foam detected—wait"

During depressurization, foam may develop from escaping CO_2. If this foam contacts the Fill sensor, the bottle will be automatically repressurized to tamp down the foam.

TIPS AND TRICKS

There is a rhythm to an efficient bottling session. Here are some tips and tricks we have found to be helpful:

- If you are going to label your bottles, it is best to do so while they are warm, dry, and empty. APPLIED FIZZICS can help you with label design and production; please contact us for assistance.
- Wet the insides of the bottles and place in ice bath or refrigerator in advance of bottling. This reduces foaming during the depressurization process.
- Sample the first bottle of each keg to ensure dilution and carbonation levels are what you expected. Keep in mind that the first bottle may have extra dilution from liquid that may have been sitting in the beverage line from the previous cleanup session. If you have switched recipes from one keg to the next, you will want to discard the first half bottle of the new batch to flush the previous batch from the lines.
- For the most efficient bottling, you want to minimize the downtime between cycles, and minimize the amount of time a filled bottle sits uncapped. Here is a workflow that accomplishes both: When a bottle has depressurized and the door opens, be ready with the next bottle in your right hand. Grab the filled bottle with your left hand and remove it from the filling nozzle, and immediately replace it with the next bottle in right hand. Then set the filled bottle down, and push the UP button with your left hand to raise the platform. Close the door to start the filling process, THEN cap the bottle you just filled. Fetch the next bottle from the ice bath or refrigerator, and set it next to the machine, ready to go for the next cycle. Repeat.
- If you are doing more than one keg of the same recipe, dump the residual ice from the previous keg, add more ice and more beverage as before, and continue.
- For extended shelf life of beverages with fresh ingredients, purge the bottle of air before filling, using the **B2 + B1** combination. You should be able to achieve shelf life of more than a month if bottles are purged before filling and kept refrigerated.

- Likewise, the first keg of each bottling session will also have air in it. If you are concerned about the shelf life of the bottles, purge the tank with CO_2 before transferring the batch to the keg. You can do this by leaving the lid of the keg ajar when you first connect the **GAS-IN** line to the keg. CO_2 will enter the keg, forcing the lighter air out. Do this for 4-5 seconds to force most of the air out, then add the batch. This will also create higher carbonation levels, since more CO_2 will be able to fit in the headspace of the keg if the air has first been purged.
- Before you begin bottling, make sure you have everything in its place – clean, empty bottles, bottle caps, capper, a place to put the bottles once filled, plenty of paper towels or bar rags for any spillage, etc. This will make for much more efficient bottling sessions.

Science of Carbonation

There are a few scientific principles about carbonation that are helpful to understand in order to get the best results out of FIZZIQ. Bear with us—it's not as bad as it sounds.

What makes a beverage fizzy? The answer is: dissolved carbon dioxide (CO_2). You want to get CO_2 into solution, and keep it there long enough to enjoy the resulting sparkling beverage. So, the key to understanding FIZZIQ is to understand how carbon dioxide gets into and out of solution, and what factors most greatly affect this process.

Getting CO2 Into Solution

Nature loves to have things in balance. FIZZIQ makes carbon dioxide go into solution by creating an imbalance. When you first mix a cocktail batch with FIZZIQ and then pressurize it, there is a large quantity of high-pressure CO_2 in the headspace above the liquid, and little or no CO_2 dissolved in the liquid. Under these conditions, CO_2 will dissolve into solution all on its own, molecule by molecule, until a balance is reached, where the concentration of gaseous CO_2 molecules in the headspace is in balance with the concentration of dissolved CO_2 molecules in the liquid. This balance, where no more CO_2 is dissolving into solution, is called equilibrium.

Factors Affecting Carbonation

The two most important factors that determine how much CO_2 will dissolve in solution are pressure and temperature. The pressure variable is sort of obvious: You might guess that the higher the pressure in the headspace of carbonation vessel, the more CO_2 would be forced into solution at equilibrium, and you'd be right. With FIZZIQ, however, the gas delivery pressure is preset by an internal regulator to an optimum value (~42.5 psi), so you don't need to consider variations in pressure, at least not initially.

More interesting is temperature—this can vary and you can control this aspect of the process. Much more CO_2 can dissolve into cold water than into warm water; and since nearly all beverages we

might consider for FIZZIQ are mostly water, this is extremely important. For CO_2 absorption, the colder the beverage, the better.

How CO_2 Escapes from Solution

When you depressurize a bottle in the machine after filling it with highly carbonated liquid, you create a situation of great imbalance: There is a huge amount of CO_2 in solution, and very little CO_2 in the headspace. And nature really abhors imbalance. From the moment you begin venting the bottle, all that extra CO_2 you added will, all on its own, molecule by molecule, start trying to get out of solution until equilibrium is once again eventually restored. Your goal is to keep as much added CO_2 as you can in solution long enough to get the bottle capped.

This process of CO_2 molecules going into and out of solution is called diffusion. If the diffusion happens at the surface, it's invisible, because molecules of CO_2 are too small to see. But if diffusion happens beneath the surface—say, CO_2 diffuses into a trapped pocket of gas—a bubble of CO_2 may form and rise to the surface, which you very much can see. Bubbles are evidence of CO_2 diffusing out of solution back into the gaseous state. So, to keep as much carbonation in the beverage as possible, we want to minimize the amount of bubbling once the beverage has been carbonated.

Making Bubbles

Here's where we have to get a little technical. It turns out that bubbles can only form on existing bubbles. That's right—there already has to be a bubble in order to make a bubble!

Have you ever noticed that when you pour a carbonated drink into a glass, streams of bubbles seem to rise to the surface from particular locations on the inside surface of the glass? This is because there are microscopic pockets of gas trapped in microscopic imperfections in the glass (or debris on the glass). CO_2 diffuses into these pockets of gas, which blow up like little balloons until their buoyancy causes them to break free and float to the surface. This process usually leaves a microscopic bit of the bubble behind, which serves as the "seed" to start another bubble, and the process begins again. These little seed bubbles on which other bubbles form are called nucleation sites. You want to minimize nucleation sites, to make sure as much CO_2 as possible makes it into the bottle, and eventually into someone's mouth.

Saturation and Stability

Once the cap or cork of a carbonated beverage has been removed, you have a highly unbalanced, unstable system that wants to return to equilibrium as quickly as possible. If you've ever shaken an open bottle of Champagne, you know that the return to equilibrium of this unstable system can be rapid, foamy, and dramatic!

There is no limit in principle to how much CO_2 can be dissolved in a liquid, but for a particular beverage in a particular vessel (say, a carbonated beverage that has just been dispensed into a bottle in FIZZIQ), there is a practical limit as to how much CO_2 can remain in solution when the headspace pressure is reduced back down to atmospheric pressure. This limit is the beverage's effective saturation point. Any dissolved CO_2 above and beyond this effective saturation level will foam uncontrollably out of solution when the headspace pressure drops below this point. Below this saturation level of CO_2, the beverage is still not completely stable (as evidenced by the bubbles streaming out of solution); but at least it is not in a violently unstable state, and the remaining bubbles will likely remain for the duration of time it takes to consume the beverage.

You can see this phenomenon with FIZZIQ. As you slowly vent the bottle after filling, the pressure inside the bottle drops; at some pressure level, the liquid will "bloom" with a rapid release of bubbles. This is because at that pressure, the amount of dissolved CO_2 is greater than the saturation level for that particular set of conditions (e.g., type of ingredients, temperature, etc.).

So--there is not much of a point to increasing the setting of the internal FIZZIQ regulator to attempt to force more CO_2 into solution, because any additional CO_2 beyond this saturation point will simply turn to foam as soon as you release the headspace

pressure. Indeed, this violent uncontrolled foaming may actually cause more nucleation and hence more bubbles and foaming than if you had carbonated the beverage at a lower pressure in the first place.

You can have some effect on the saturation level. The key to making the effective saturation level as high as possible, thus minimizing the rapid loss o f CO_2 through uncontrolled foaming, is to minimize the things that cause bubbling. That means minimizing agitation (splashing creates bubbles which serve as seeds for more bubbles); reducing contact with surfaces rich in nucleation sites; and keeping the liquid temperature as low as possible to maximize the amount of CO_2 that be dissolved in solution under the ambient conditions.

Your mouth is loaded with nucleation sites, and you want to keep as much of the CO_2 in your beverage until it can fizz where it counts!

Ice Melt and Dilution

Ice chills a beverage not by being cold, per se, but by melting. The process of melting ice—i.e., turning it from solid to liquid--takes an extraordinary amount of heat, and this heat comes from the liquid surrounding the ice. The ice “steals” heat from the surrounding liquid in order to melt, thus cooling the liquid. For every gram of ice that melts, 80 calories of heat is removed from the surrounding water. Since the removal of one calorie from one gram of water will lower its temperature by one degree Celsius (by the definition of a calorie), melting just one gram of ice can chill a lot of water!

Let’s go through the process in detail of what happens when you put ice in water. Now, you know that ice melts at 32° F, but be aware that Ice is usually well below 32° F—it will generally be at whatever temperature the freezer that made it is set to (typically around 0° F)

When the ice and water are first mixed, the ice begins to chill the water a little bit simply due to the fact that the ice is colder than the water; likewise, the ice begins to warm up, simply because the water is warmer than the ice.

Now, when the ice warms all the way up to 32° F, it starts to melt—and that is where the real chilling power of ice comes in: every gram of ice that melts sucks 80 calories of heat from the surrounding liquid, rapidly bringing the temperature of the surrounding liquid down towards 32° F. Ice will continue to melt as long as the temperature of the surrounding water is above 32° F.

Eventually, assuming there is enough ice to begin with, the entire container of water will be at 32° F, and any remaining ice will also be at 32° F. The entire mixture of water and ice is now said to be in equilibrium, and there will be no further ice melt (at least not initially—over time, heat will be absorbed from the outside environment, which will lead to some further ice melt). Even if you add more ice at this point, you will not get additional ice melt, because the mixture is already at 32° F. In fact, adding cold ice (i.e., well below 32° F) at this point would actually cause reverse dilution, freezing some of the liquid water into ice!

For our purposes of effectively using FIZZIQ, then, we only need to determine how much ice is enough to get our batch mixture down to 32° F (because this is the optimum temperature for CO_2 absorption and retention), and how much extra dilution from ice melt will result from adding this ice, so we can adjust our recipes accordingly.

Here are our FIZZIQ rules of thumb for ice:

- For every liter of liquid ingredients at room temperature, chilling it all the way to 32° F (0° C) will require about 300 g of ice, and thus result in 300 g of extra dilution. This works out to about 10 ounces of ice melt per quart of liquid ingredients.
- Adding more than 300 g of ice will not lead to any extra dilution, so err on the side of adding more ice than necessary. We recommend putting about as much ice in the keg as there is liquid. In other words, if you have enough batched liquid to fill the keg half full, fill the keg half full with ice before transferring the liquid to the keg.

FREQUENTLY ASKED QUESTIONS (FAQ)

Q: What is the shelf life of bottled cocktails made with FIZZIQ?

A: If care is taken to purge the bottles of CO_2 before filling, and kept refrigerated afterwards, bottled cocktails made with FIZZIQ should last over a month, even if they contain fresh juices. The reason is that the mixture is never exposed to air in the carbonation and bottling process, so the beverage has no opportunity to oxidize; also, carbon dioxide acts as a natural preservative. If the cocktail contains only spirits, the shelf life can be many months.

Q: How long will the carbonation last in the bottles once capped?

A: The carbonation will last indefinitely if properly capped.

Q: Where can I find suitable bottles?

A: Bottles can be obtained from us, or purchased on the open market. Only use bottles that are rated for Champagne pressures! If you have any questions about whether your bottles are suitable, please contact us.

Q: How many bottles per hour can FIZZIQ produce?

A: Up to 100 bottles per hour can be produced with FIZZIQ once everything is ready to go. If you include setup, batching, carbonation, bottling, and cleanup, an average pace is about 50 bottles per hour.

Q: What is the fog that you see in the bottle when it pressurized and depressurized?

A: When a gas expands it cools, and the colder a gas is, the less moisture in can hold. As high pressure gas enters the bottle it cools because of expansion, and condensation forms—just like a cloud in the atmosphere. The same happens when the bottle is depressurized—the expanding gas cools.

Q: What is the CO_2 consumption of the system?

A: You will get about 100 small bottles (e.g., 187 ml), or five gallons of beverage, for every two pounds of CO_2. So a 10-lb tank should give you 500 small bottles.

WARRANTY

Perlage Systems Inc. warrants that the FIZZIQ Bottling System will be free from defects in materials and workmanship for a period of 12 months from the date of shipment. If the product proves defective during the warranty period, Perlage Systems Inc. at its option, will:

(1) Repair the product by means of telephone support or depot service at no charge for parts or labor;

(2) Replace the product with a comparable product which may be new or refurbished or;

(3) Refund the amount paid for the product, less a reasonable allowance for usage, upon its return.

Perlage Systems Inc. recommends the Customer first utilize support materials shipped with the product and Perlage Systems Technical Support. If unsuccessful, to obtain service under this warranty the Customer must notify Perlage Systems Inc. or its authorized service representative of the defect before the expiration of the warranty period. Customers will provide appropriate assistance to Support personnel to resolve issues. If Support is unsuccessful, Perlage Systems Inc. or its authorized service representative will instruct the customer on how to receive warranty repair. Service is available in the United States, for products purchased in and outside of the United States. Perlage Systems Inc. reserves the right to charge for service in exceptional cases.

A description of the depot process may be obtained from the Perlage Systems Inc. Customer Support Center or authorized reseller/distributor. Depot service is at Perlage Systems Inc. or its authorized service representative's sole discretion and is considered an option of last resort.

In the maintenance of the product, Perlage Systems Inc. may use new or equivalent to new parts, assemblies or products for equal or improved quality. All defective parts, assemblies, and products become the property of Perlage Systems Inc. Perlage Systems Inc. may require the return of parts, assemblies and products to a designated Perlage Systems Inc. Depot or the Perlage Systems Inc. representative from which the part, assembly, or product was originally purchased. Return and claims will be handled according to the current Perlage Systems Inc. procedure.

Warranty excludes improper or unsafe use, abuse, or any use that is not consistent with the operating instructions and warnings. These warranties shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Perlage Systems Inc. shall not be obligated under these warranties:

a) To repair damage resulting from attempts by personnel other than Perlage Systems Inc. representatives to install, repair or service the product unless directed by a Perlage Systems Inc. representative.

b) To repair damage, malfunction, or degradation of performance resulting from improper use or connection to incompatible equipment.

c) To repair damage, malfunction, or degradation of performance caused by the use of non Perlage Systems Inc. supplies or consumables or the use of supplies not specified for use with this product.

WARRANTY

d) To repair an item that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product or degrades performance or reliability.

e) To perform user maintenance or cleaning or to repair damage, malfunction, or degradation of performance resulting from failure to perform user maintenance and cleaning as prescribed in published product materials.

f) To repair damage, malfunction, or degradation of performance resulting from use of the product in an environment not meeting the operating specifications set forth in the user manual.

g) To repair damage, malfunction, or degradation of performance resulting from failure to properly prepare and transport the product as prescribed in published product materials.

h) To replace items that have been refilled, are used up, abused, misused, or tampered with in any way.

i) To install replacement items that are considered customer replaceable.

j) To support parts not supplied by Perlage Systems Inc.

k) To provide parts or hardware updates or upgrades.

Any service identified in the above list and provided by Perlage Systems Inc. at the Customer's request, shall be invoiced to Customer at Perlage Systems Inc.'s current rates for parts, labor and travel.

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NOTES...

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