

BASIC POST-MIX SYSTEMS

Training Manual



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BASIC POST-MIX SYSTEMS TRAINING MANUAL

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LESSON 1: FITTINGS & TUBING

INTRODUCTION

Proper installations and properly operating equipment depend on correct fittings and tubing. After completing this lesson, Fittings & Tubing, you will understand what is available and how to properly use various fittings and tubing.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

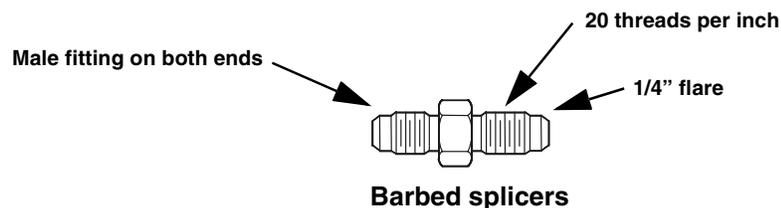
1. What is the difference between barbed and flared fittings?
2. All fittings must be selected based on size.
3. Oetiker clamps should always be thrown away after using.
..... True False

LESSON

Study the following material about fittings and tubing and answer the questions in the Review section. These questions summarize the most important points in this lesson.

Glossary of terms and abbreviations

RH Right Hand	FL Flare
LH Left Hand	SW Swivel
o.d. Outside Diameter	F Female, Internal Threads and/or Flare
i.d. Inside Diameter	M Male, External Threads and/or Flare
SS Stainless Steel	MPT Male Pipe Thread
BR Brass	FFL Female Flare
NPT National Pipe Thread	MFL Male Flare



Relationship of Thread size to Flare size:

- 7/16–20 Thread size is a 1/4” Flare
- 1/2–16 Thread size is a 5/16” Flare
- 5/8–18 Thread size is a 3/8” Flare

Fitting types

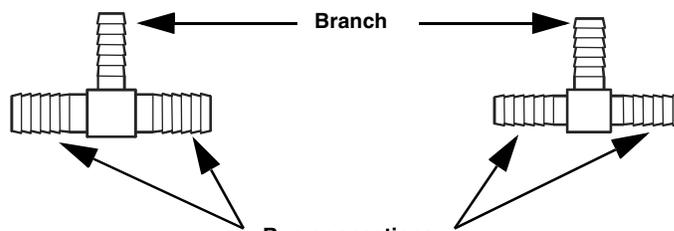
The term “fittings” covers a lot of hardware. It would be difficult to list every possible fitting available. The following is a listing of the common fittings and their uses. All barbed fittings are sized to match the tubing being used. Always be sure to use the correct size fitting for any tubing--otherwise leaks will result.

Barbed splicers come in many sizes and combinations of sizes to allow splicing of tubing of the same and different sizes.



Barbed splicers

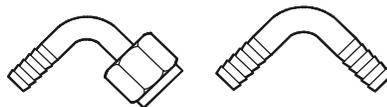
Barbed tees come in several varieties and sizes.



Barbed tees

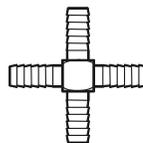
Barbed tees with all three connections barbed are very common. Usually the *run* connections are the same size and the *branch* connection can be either the same or a different size.

Elbows, barbed and a combination of barbed and flare are used to connect tubing when space is limited and kinks must be avoided.



Flare with swivel and barbed elbows

Barbed crosses are used when two tubes must be cut and connected together in one common joint. The barbed fittings may vary in size to suit the situation.



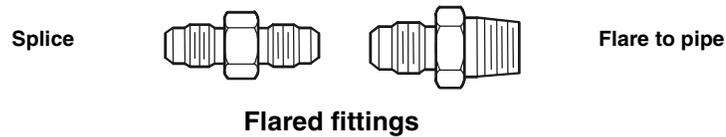
Barbed cross

U-bends are used mainly with circulating carbonated water. The U-bends come with several sized barbed fittings and with multiple outlets. U-bends are sometimes referred to as turn-arounds.

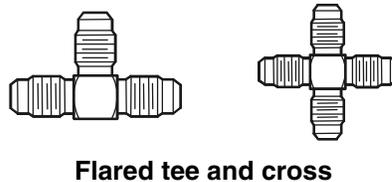


Barbed U-bends

Flare fittings are designed to do the same job as barbed fittings, but these joints can easily be taken apart and put back together. A flare splice and a flare-to-pipe fitting are shown. Both the flares and the pipe fittings are available in many sizes.

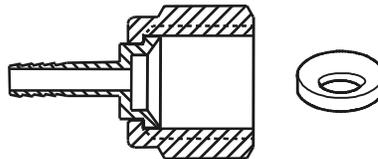


Also in the flare fitting category are tees and crosses.



Stem and swivel nut

The stem is designed so the barb will properly fit the i.d. of a specific size tubing. It is important that the proper stem and tubing are used together or leaks can result.

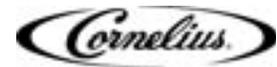


Stem and swivel nut and washer

The stem is also designed to fit the swivel nut. The opening in the swivel nut for the stem must be the proper size so the stem is properly supported.

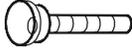
The joint between the female portion (stem) of the joint and the male portion is sealed with a nylon washer. There is a washer for each flare size and they are color-coded for easy identification: white 7/16, red 5/16, and black 3/8.

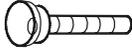
The washer provides a malleable material to seal between the two metal surfaces.

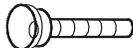


Fitting reference charts

The following three tables show the part numbers for swivel nut fitting sets that are available from Cornelius. The lists are based on the tubing size (i.d. & o.d.) for each swivel nut thread size (flare size).

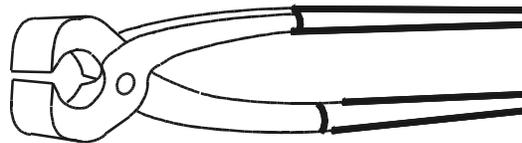
Fittings 7/16" 20 (1/4" flare)					
Tubing i.d. x o.d.					Use die set
	Stem	Swivel nut	Clamp	Ferrule	
.265 x .465 (thin wall)	Cornelius part number				
	77010400	77010100	300200000	176295000	#46
.265 x .520	77010400	77010100	300551000	176067000	#50
.156 x .400	77010600	77010100	311908000	176001000	#40
.156 x .312	77010600	77010100	311527000	176004000	#31
.265 x .478	77010400	77010100	300200000	176000000	#47
.250 X .395	77010400	77010100	311908000	176001000	#40
.375 X .610	77030500	77010100	309852000	176204000	#61
.375 X .535	77030500	77010100	111353000	176067000	N/A
.265 X .426	77010400	77010100	311908000	176295000	N/A
.265 X .375	77010400	77010100	309854000	176004000	N/A

Fittings 5/8" 18 (3/8" flare)					
Tubing i.d. x o.d.					Use die set
	Stem	Swivel nut	Clamp	Ferrule	
.265 x .465 (thin wall)	Cornelius part number				
	77030400	77030100	300200000	176295000	#46
.265 x .520	77030400	77030100	300551000	176067000	#50
.156 x .400	77030500	77030100	309852000	176204000	#61
.156 x .312	311344000	311345000	111085000	N/A	N/A
.265 x .478	77030500	77030100	111353000	176140000	#52
.250 X .395	77030400	77030100	300200000	176000000	#47
.375 X .610	77030500	77030100	309852000	176204000	N/A
.375 X .535	77030400	77030100	300551000	176140000	N/A
.265 X .426	77030400	77030100	300551000	176001000	N/A
.265 X .375	77030500	77030100	111353000	176067000	N/A

Fittings 1/2" 18 (5/16" flare)					
Tubing i.d. x o.d.					Use die set
	Stem	Swivel nut	Clamp	Ferrule	
.265 x .465 (thin wall)	Cornelius part number				
	77020400	77020100	300200000	176295000	#46
.265 x .520	77020400	77020100	300551000	176067000	#50
.156 x .400	77020700	77020100	311908000	176001000	#40
.156 x .312	77020700	77020100	311527000	176004000	#31
.265 x .478	77020400	77020100	300200000	176000000	#47

Oetiker clamp

The Oetiker clamp is designed to be pinched with a clamp pincer at the ear. The clamp shown wraps to form a full circle, thus spanning the gap created by the ear. This permits the clamp to apply even pressure around the entire perimeter of the tubing, minimizing leaks.



Oetiker clamp and pincers

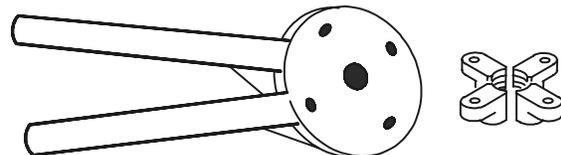
Oetiker clamp installation

1. Slide clamps on tubing (be sure to leave a small space between the end of the tubing and the nut).
2. Install tubing on fitting.
3. Position clamp behind first barb fitting for clamping.
4. Use pincer to squeeze clamp tight.

The pincers are designed to pinch the "ear" without cutting it off. Be sure to use Oetiker Pincers when using this clamp. The tubing should not be distorted when clamping pressure is applied.

Ferrules

The ferrule looks like a short piece of stainless steel tubing with a rolled shoulder at one end. The size # is stamped on the side of the ferrule. The ferrule provides uniform pressure over the entire length of the stem barb. This ensures that leaks will not occur.



Ferrule, clamp, and die



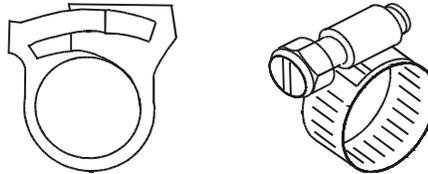
Ferrule clamping tools

Ferrules can be clamped with a Vice-Grip style pliers with jaws adapted to clamp the ferrule. Also available is a clamping tool with four dies that apply pressure to the ferrule on four sides of the ferrule to ensure accurate clamping.

Each ferrule requires a certain size die set. See the reference charts in this lesson.

Other clamps

Reusable snap clamps are suitable for clamping tubing that is not under pressure, such as drain tubing. This clamp can be pinched tight with a pliers and then taken off by sliding the locking sections apart.



Snap and screw clamps

The screw clamp is suitable for pressurized connections but because of its size (bulky) it is not always a good choice. This clamp is often used for drain connections.

REVIEW

1. Which clamp is designed to be pinched or crimped?
2. A screw clamp is often used for connections.
3. What is the purpose of a ferrule?
.....
.....
4. Reusable snap clamps can NOT be used for tubing that
5. What advantage does a flare fitting have over a barbed fitting?
.....
.....

NOTES

LESSON 2: CO₂ CYLINDERS/BULK TANKS

INTRODUCTION

Careful handling and maintenance of CO₂ cylinders is absolutely necessary. After completing this lesson on CO₂ cylinders you will understand how safety and convenience relate to CO₂ cylinder installation and use.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. Who fills CO₂ cylinders?
2. What size and type of cylinders are used in the beverage dispensing industry?
.....
.....
3. CO₂ cylinders should always be handled with safety in mind?
..... True False

LESSON

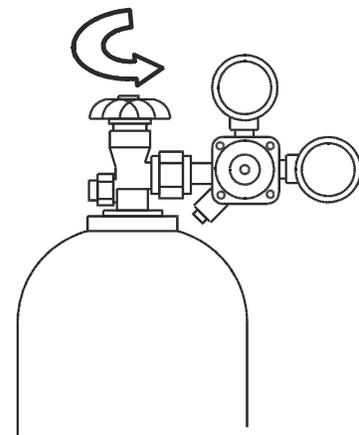
Study the following material about CO₂ cylinders and answer the questions in the Review section. These questions summarize the most important points in this lesson.

CO₂ is used for beverage carbonation and for syrup propulsion. It is sometimes also used to operate pneumatic cylinders in a system.

CO₂ cylinders hold compressed CO₂ in gas and liquid form. A 20-pound CO₂ cylinder when properly filled holds 20 pounds of liquid CO₂. Normal pressure inside a high pressure cylinder is ambient temperature dependent (about 800 psi at 72°F). When a CO₂ cylinder is in use, the valve should be opened all the way until it is back seated. However do not transport or store cylinders with the valve open. Always keep the valve closed when the cylinder is empty to prevent contamination by dust, moisture, and oils. When storing cylinders for long periods, they should contain at least small amount of CO₂ pressure.

Installation of CO₂ tanks is often handled by beverage bottling companies.

For information on the operation of CO₂ equipment see the lesson on CO₂ Regulators for more information.



CO₂ storage

There are two varieties of CO₂ cylinders, high pressure and low pressure also called bulk tanks.



High pressure cylinders typically contain 10, 20, or 50 pounds of CO₂. These cylinders are made of aluminum or steel and have a valve at the outlet. The valve has a rupture disk that protects against over-pressure conditions. High pressure CO₂ cylinders are returned for refilling.

CO₂ can also be stored in low pressure cylinders that are made of stainless steel and are thermally insulated. These containers typically hold 200 or 400 pounds of CO₂.

High pressure cylinders

Common high pressure cylinders are 20- and 50-pound cylinders.

A 20-pound CO₂ cylinder is designed to hold 20 pounds of liquid CO₂, a 50-pound CO₂ cylinder is designed to hold 50 pounds of liquid CO₂.

Important Information to remember:

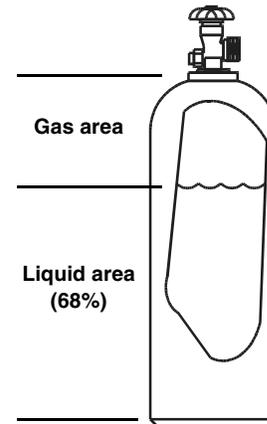
- When any CO₂ cylinder is filled to its “fill weight,” it is two-thirds full.
- The space above the liquid is needed for generation (expansion) of the CO₂ gas.

Overfilling a cylinder can be very dangerous.

Normal pressure inside a high pressure cylinder is ambient temperature dependent (about 800 psi at 72°F).

Note: Cylinder pressure increases with temperature.

Regulator on tank is “primary” and must support 500 psi minimum.



High pressure CO₂ cylinder
(properly filled)

Low pressure bulk cylinders

Low pressure cylinders are permanently installed and are refilled on site. An optional fill box can be located outside the building, allowing suppliers to check CO₂ levels and fill when necessary without entering the building. Filling of a bulk tank does not interrupt drink dispensing operations.

Regulator on tank is “secondary” and must support 200 psi maximum.

Low Pressure Cylinder Specifications		
	200 Lb. cylinder	400 Lb. cylinder
Max. allowable working pressure	300 PSIG	
Normal operating pressure	110-200 PSIG	110-200 PSIG
Max. allowable evaporation rate	1.5 lbs./day	4.0 lbs./day
Vacuum jacket material	painted carbon steel	
Inner jacket material	type 304 stainless steel	
Insulation type	multi-layer foil & paper/high vacuum	

CO₂ problems

Moisture that gets into a CO₂ cylinder creates problems. The most serious of these problems is the formation of carbonic acid. When moisture enters the cylinder and comes in contact with CO₂, carbonic acid is formed and damage can occur to cylinder walls.

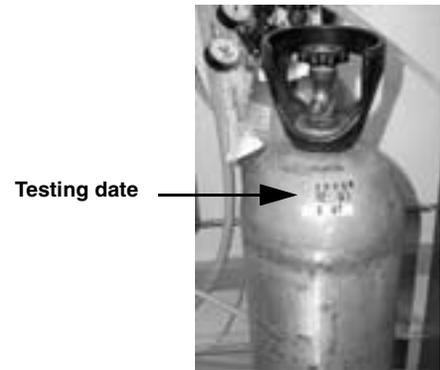
Carbonic acid is present in carbonated water but in that situation the concentration is very weak.

Avoid any situation that allows moisture or oil to get into the cylinder. Besides cylinder damage these contaminants also cause off taste problems that can be difficult to diagnose.

Cylinder control

CO₂ cylinders are controlled by the Federal Department of Transportation (DOT). Any person filling cylinders must be familiar with the laws applying to CO₂ cylinders. Any person testing cylinders must be certified by the DOT.

DOT regulations require that CO₂ cylinders be inspected every five years. The inspection includes a cylinder interior check using a camera as well as a pressure test to verify cylinder wall integrity. Tested cylinders are stamped with the month and year of the test. Cylinders that fail the test are marked and returned to the owner for disposal. The owner is responsible for proper disposal.



CO₂ cylinder transportation

Store and transport cylinders upright and chained or nested on trucks. Always store chained or in an egg crate type container. When in use always chain in an upright position to keep liquid CO₂ out of regulators and tubing.

Never carry CO₂ cylinders inside the driving compartment of a vehicle. In the event of leaking or rupture disc failure, the carbon dioxide displaces oxygen and CO₂ does not support life. An event like this can happen instantly leaving little time for reaction.

CO₂ safety

High pressure CO₂ cylinders must be handled with care. The internal pressure is very high, up to a maximum 1800 psi.

 **CAUTION** - When the cylinder is not in use always keep the cylinder valve closed to prevent any moisture from entering the cylinder. Any moisture in a CO₂ cylinder can cause carbonic acid to form and corrode the cylinder walls. Corrosion can reduce the wall thickness and the cylinder can rupture.

 **WARNING** - Always secure the cylinder so it cannot be knocked over. If a cylinder is knocked over, the valve can break and the cylinder will become an unguided missile. Serious and possibly fatal injuries can occur.



 **DANGER** - CO₂ displaces oxygen. Strict attention must be observed in the prevention of CO₂ gas leaks in the entire CO₂ and beverage system. If a CO₂ gas leak is suspected, particularly in a small area, immediately ventilate the contaminated area before attempting to repair the leak. Personnel exposed to a high concentration of CO₂ gas will experience tremors that are followed rapidly by loss of consciousness and suffocation.



LESSON 3: CO₂ REGULATORS

INTRODUCTION

Almost every aspect of serving beverages involves CO₂. Consequently a thorough knowledge of CO₂ regulators is essential for every service technician. When you have completed this lesson on CO₂ regulators you will have a better appreciation for the role regulators play in the serving of a quality beverage.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. What is the purpose of a CO₂ regulator?
-
-
-
2. What determines the pressure range of a regulator?
-
-

LESSON

Study the following material about CO₂ regulators and answer the questions in the Review section. These questions summarize the most important points in this lesson.

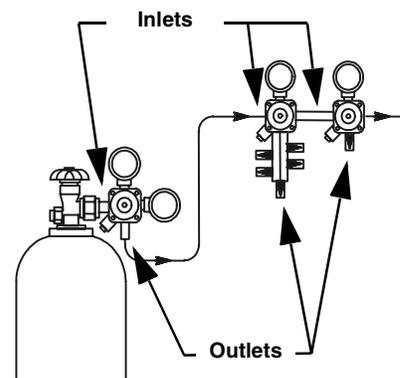
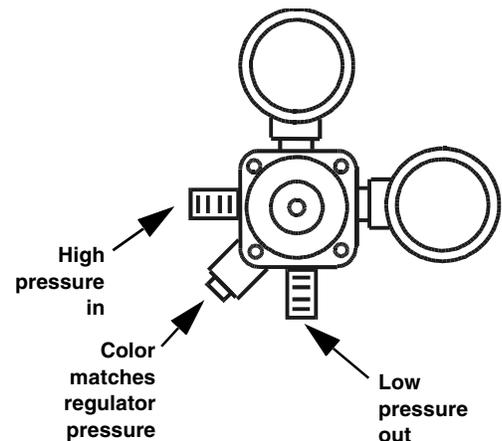
The pressure in a CO₂ cylinder is higher than needed for operation of a beverage system. A CO₂ regulator reduces the high inlet pressure to a usable operating pressure. Therefore, we need to reduce that pressure to a usable pressure. Depending on the inlet pressure a primary regulator or a secondary regulator is used.

Primary regulators require minimum inlet pressures of 500 psi. Secondary regulators require low pressures of 200 psi maximum.

Some people use the terms primary when referring to the inlet or high pressure side of a regulator and secondary when referring to the outlet or low pressure side of a regulator. Please do not confuse this use of these terms.

Throughout this lesson the terms inlet and outlet are used to avoid confusion. See the list below for words that are sometimes used in place of inlet and outlet.

- Inlet: High pressure, High side
- Outlet: Low pressure, Low side





Regulator configuration - Pressure ranges

Primary Regulators	Secondary Regulators
0 – 30 psig (purple)	0 – 30 psig (orange)
0 – 60 psig (green)	0 – 60 psig (blue)
0 – 100 psig (black)	0 – 100 psig (gold)
0 – 160 psig (red)	0 – 160 psig (brown)

CO₂ regulators are configured to provide the greatest accuracy possible by limiting the operating range of the regulator.

Regulators are the most accurate in the center-half of the range.

For Example: A 0 – 60 psi regulator is most accurate from 15 psi to 45 psi. For a desired operating pressure of 35 psi, the best regulator would be the 0 – 60 psi regulator, since 35 psi is within the center range of that regulator.

The pressure range of the regulator is determined by the spring that applies pressure on the diaphragm. Four different springs can be used. They are color-coded for easy identification.

- 0 – 30 psi - - - - Green
- 0 – 60 psi - - - - Black
- 0 – 100 psi - - - - Silver
- 0 – 160 psi - - - - Gold

The springs are color-coded for easy identification.

Regulators that are built with a 0 – 30 psi spring will also have a 0 – 30 psi gauge installed at the secondary outlet. The regulator has a label on its top identifying the psi range.

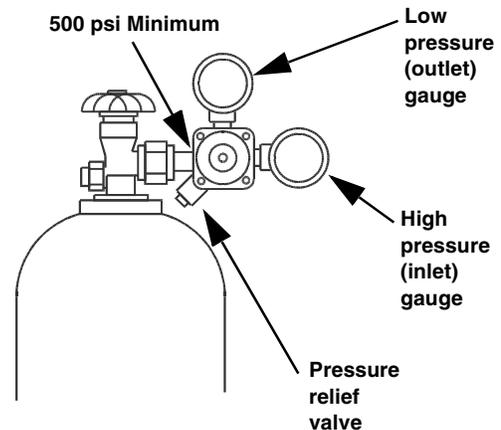
NOTE: It is very important that the regulator gauge and label indicate the actual operating range of the regulator. Much confusion and a possibly dangerous situation could occur if a spring were changed without changing the gauge or label.

Primary regulator introduction

A primary CO₂ regulator must be attached to a high pressure source, such as a high pressure CO₂ cylinder, either directly or by a high pressure hose. A primary regulator requires a minimum of 500 psi inlet pressure.

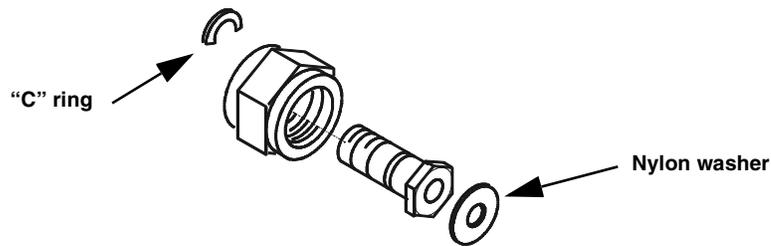
There are usually two gauges attached to the regulator—one that shows the inlet pressure from the CO₂ cylinder and one that shows the regulated or operating pressure that is available at the outlet.

Primary regulators are equipped with pressure relief valves to relieve any unusually high pressure that would reach the secondary side of the regulator.



Primary regulator cylinder connections

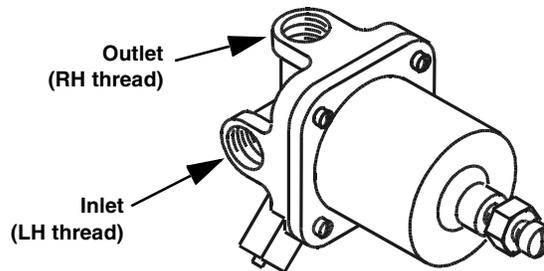
The regulator mounts to the cylinder with a coupling nut as shown. The “C” ring holds the nut onto the stem.



The nylon washer must be in place to provide a seal between the cylinder valve and the stem. Some stems may have an O-ring embedded into the face of the stem instead of a washer.

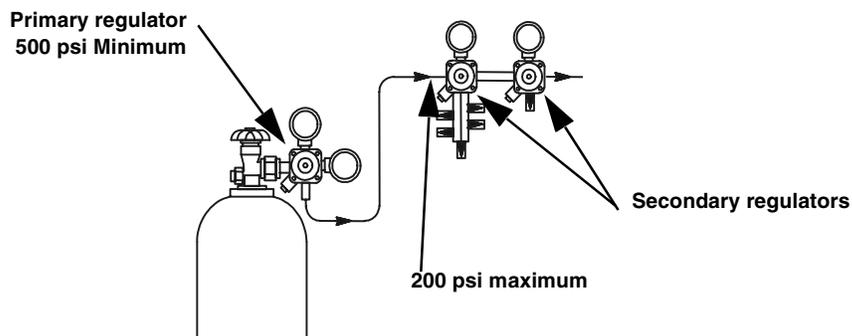
The stem has left-hand threads for installation onto the cylinder.

Primary regulators have four threaded connections. Two of the connections are used for the high pressure gauge and for connecting to the cylinder. These two connectors have left hand threads to prevent accidental connection of the cylinder to the outlet side of the regulator. The other two outlets have right hand threads and are used for the outlet pressure gauge and the fitting or check valve used to connect to tubing.



Secondary regulator introduction

Secondary regulators usually receive their inlet pressure from a primary regulator. The maximum allowable inlet pressure for a secondary regulator is 200 psi. Secondary regulators always have a pressure gauge.



LESSON 4: SYRUP TANKS

INTRODUCTION

Since syrup is a prime ingredient in the post-mix drink, it is important that the syrup container is fully understood. This section deals with the stainless steel tank. After completing this Lesson you will recognize a variety of tanks and understand their basic operation.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. What are the advantages of stainless steel tanks?
2. Are tank parts interchangeable from one manufacturer to another?
3. What is the purpose of a siphon tube?

LESSON

Study the following material about syrup tanks and answer the questions in the Review section. These questions will summarize the most important points in this lesson.

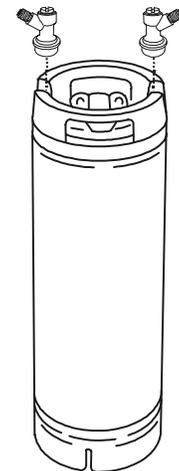
Tanks, general information

Stainless steel tanks have been used as syrup containers since the beginning of the bulk beverage industry. The tanks are reusable and with care they last for many years. The tank must be returned to the packaging plant, washed, sanitized, and then refilled. Although there is considerable handling, the overall maintenance cost is low.

If the rubber skirts (tops and bottoms) of the tanks become loose they should be sent out for refurbishment.

Tank operating pressure

Syrup tanks have a maximum operating pressure of 130 PSIG. Normal operating pressure is usually in the range of 50 to 70 PSIG.



Syrup cylinder

Tank handling and warnings

Tanks can be damaged by certain chemicals. Chlorine for example, if not used properly (in dilute concentrations), will damage the stainless steel and corrode the metal.



WARNING - Do not attempt to remove the cover from a tank when it is under pressure.

Always fully relieve the pressure before attempting to open the tank.



CAUTION - Do not use components from one manufacturer's tank for another. Parts are not interchangeable and a dangerous situation can result.

Tank sizes and models – Spartan

The Spartan tank has a molded base and a replaceable top handle. This tank has an 8-1/2 inch diameter and is available in the following capacities:

- 384 ounce
- 614.4 ounce
- 640 ounce (maximum)

Tank sizes and models – MSR Super Champion

The MSR (More Shock Resistant) Super Champion tank has molded top and bottom skirts to protect the tank. The tank is designed so that when the tank is lying down it rests on the skirts and not the stainless steel side wall.

These tanks are all 8-1/2 inch diameter and 640 ounce capacity.

Tank sizes and models – Redguard

The Redguard is manufactured for the repackaging of syrup. It is 9 inches in diameter and has a capacity of 640 ounces.

Tank sizes and models – Tufguard

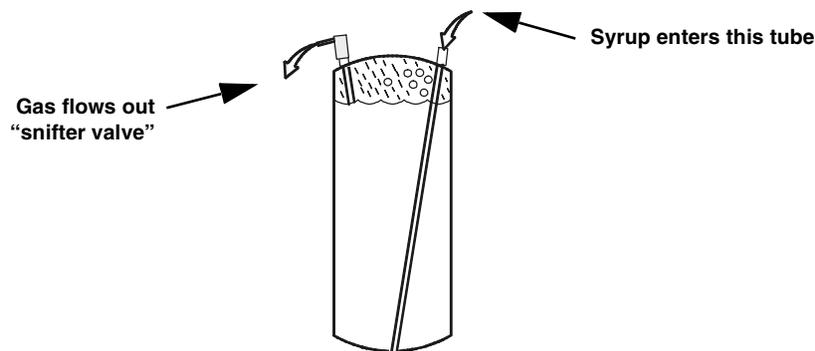
The Tufguard is also manufactured for the repackaging of syrups. It is 9 inches in diameter and has capacities of:

- 640 ounces
- 608 ounces

Syrup capacity

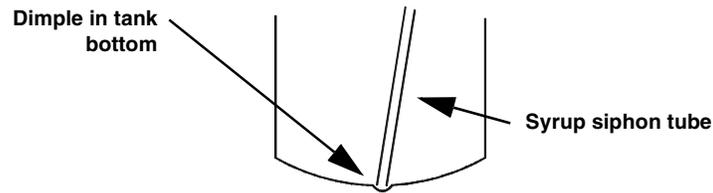
The different fill capacities (608, 640 ounces, etc.) are determined by the length of the gas tube that is used. The 384 ounces. (3 gallon) tank is a different height than those tanks with greater capacity.

The drawing illustrates how the gas tube determines the fill capacity.



The syrup enters the pressurized tank at the siphon tube and fills from the bottom. Because the tank is sealed, a "sniffer valve" is attached to the gas disconnect so that the gas can escape from the tank as the syrup enters under pressure. When the syrup reaches the gas tube the liquid closes the tube opening so that no more gas can escape. The syrup will stop flowing into the tank once the pressure inside the tank equals the pressure of the syrup entering the tank.

The syrup siphon tube fits into a small “dimple” in the bottom of the tank. This ensures that virtually all of the syrup will be forced from the tank. All models of IMI Cornelius tanks have this feature.

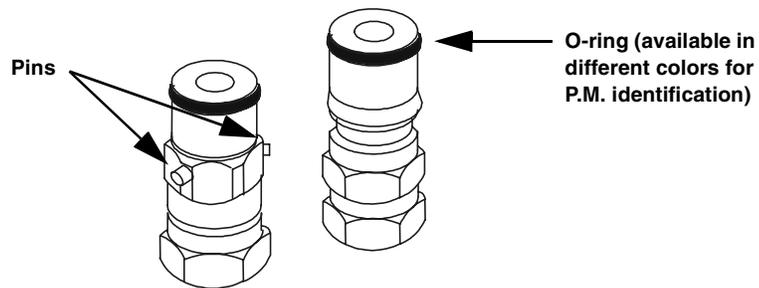


Quick disconnect fittings

The tanks are available with ball-lock quick disconnect fittings or with pin type fittings. Although not shown here, there was a latch style disconnect fitting used many years ago but it is now obsolete.

In the ball-lock style disconnect fitting, the gas and liquid fittings are distinguished by the diameter of the fitting and the distance between the ball-lock groove and the end of the fitting. The gas fitting has a scalloped edge at the base of the connector; the liquid fitting has a hex base.

In the pin style disconnect fitting, the gas and liquid are distinguished by the number of pins—two for gas and three for liquid.

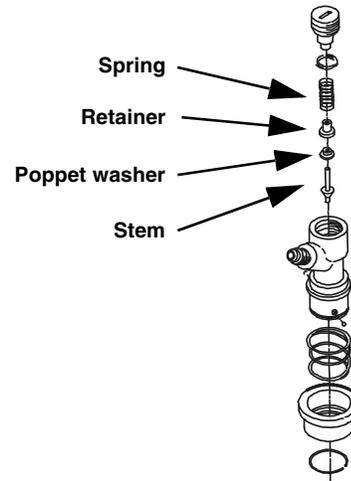


The seal between the fitting and the quick disconnect is an O-ring on the fitting.



Quick disconnect poppet valves

The quick disconnect (QD) and the quick disconnect fitting on the tank are both equipped with poppet valves. These valves ensure that the pressurized liquid stays in the tank and tubing. When the QD is applied to the fitting, the tank poppet and the QD poppet open and the connection is “made”, the joint being sealed by the O-ring on the tank fitting.



Tank covers

Tank covers manufactured after January 1, 1979 must conform to NSDA voluntary industry standards. Covers must be made of stainless steel and have a relief valve designed to open at 130 psi. The cover will be stamped “NSDA-VS-01”, indicating compliance to the standard.

The relief valves come in two styles:

- With a pull ring
- Without a pull ring

Remember: Don't use tank covers from one manufacturer for another manufacturer's tank.



Syrup tank covers, with and without pull-ring

REVIEW

1. Before attempting to remove the cover of a tank?
2. What is the purpose of the dimple in the tank bottom?
3. Quick disconnect fittings are made for both and
4. The sniffer valve allows gas to from the tank as enters.

NOTES

LESSON 5: BAG-IN-BOX

INTRODUCTION

As a service technician of beverage dispensing equipment, understanding the bag-in-box (BIB) container and the associated pump systems is very important. After completing this lesson you will have a better appreciation for this container system.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

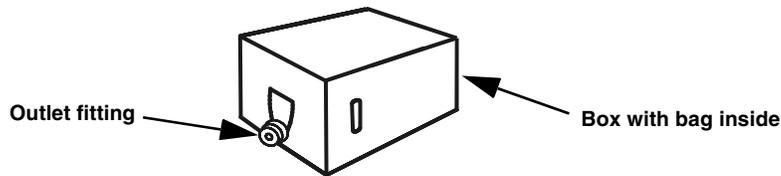
1. Why were BIB containers developed?
2. What does a changeover valve accomplish?
3. Pumps should be connected to valves.

LESSON

Study the following material about Bag-in-Box and answer the questions in the Review section. These questions summarize the most important points in this lesson.

The Bag-in-Box container

The BIB container was developed to eliminate the need to return the syrup tanks for washing and sanitizing. The BIB is a one-way container. Once it is empty, it is thrown away. The container shape and size makes storage easier also.



Because the syrup is pumped out of the container, CO₂ does not come in contact with it eliminating syrup carbonation problems.

How it works

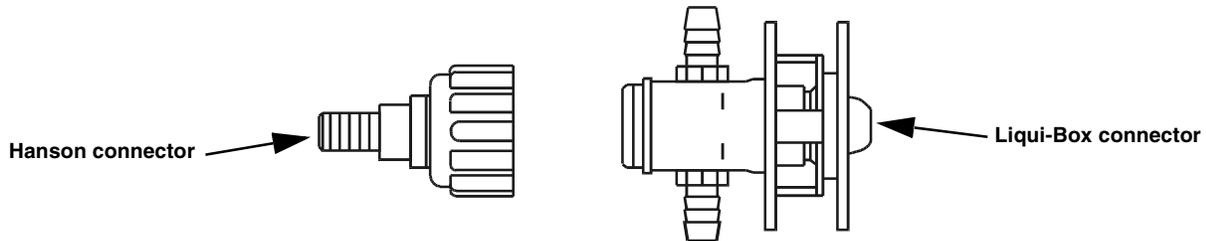
The box is triple-wall corrugated cardboard treated to resist moisture. Inside the box is a bag containing the syrup. The bag is multi-layered with an outlet fitting at one end to which a connector is attached. The connector is the link to the pump.

In simple terms the syrup is pumped out of the bag, which collapses as it empties.

BIB styles

One style of BIB requires that the box is placed so that the outlet fitting is at the lowest point.

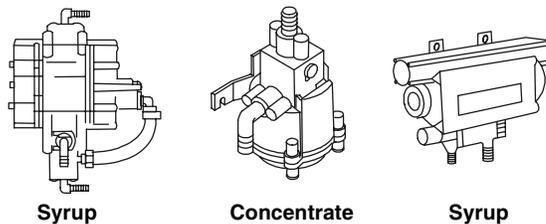
Another style has a probe inside the bag so that the bag outlet can be at the top and the syrup will still be pumped from it.



The two most commonly used connectors are the Hanson and the Liqui-box disconnects. The Hanson is used with bags that have internal probes. The Liqui-box is used with the BIB that must have the connector at the lowest point.

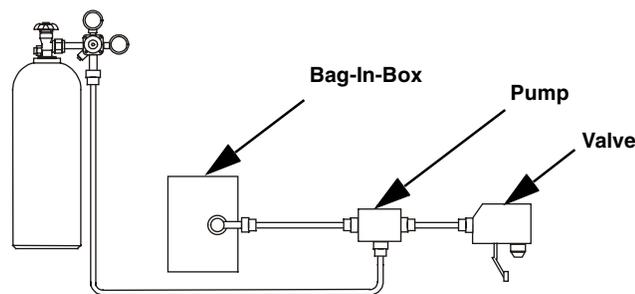
Pumps

There are many different pumps from a variety of manufacturers. The most common style pump is gas operated. CO₂ is used because it is also required for the carbonator.



Pump connections

Ideally there would be one BIB container connected to one pump furnishing one dispensing valve.



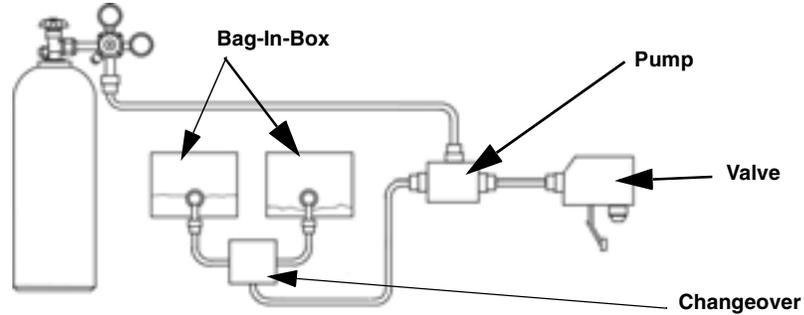
However, this doesn't always suit the needs of the installation. Often multiple BIB containers are connected together to increase the amount of syrup on line eliminating the need to frequently change containers.



CAUTION - Although connecting more than one BIB to a pump is a common practice, never connect more than one valve to a pump. One pump will not usually be able to supply two valves and drink quality will suffer.

Multiple BIB/one pump

The most common method of adding additional BIB containers is to use a change-over valve. This device looks like a tee between the two BIB containers but acts like a switch. The change-over will cause the pump to draw from only one BIB container. When that container becomes empty, the change-over will sense a vacuum and switch to the full container.



This permits the operator to change the empty BIB container without interrupting the operation.

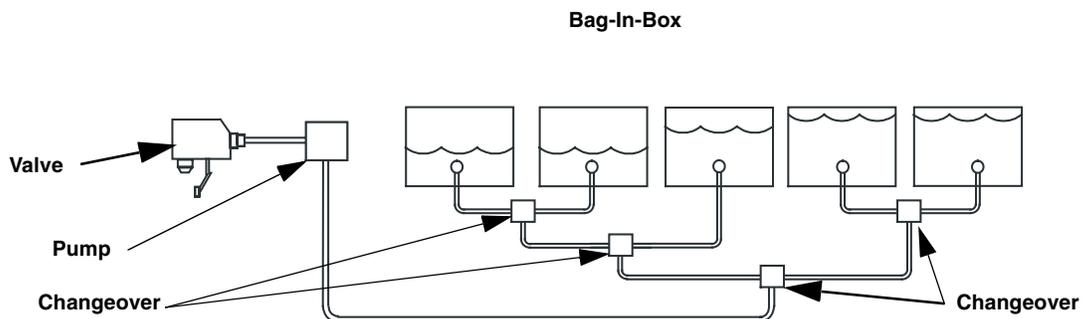
Tee vs. change-over

If the two BIB containers were connected together with a common tee, both BIB containers would empty at the same rate. Twice as much syrup is on line but when the BIB containers go empty, you're out of syrup.

The change-over allows the operator to keep a full BIB container on line at all times, always ready to be put into service.

High volume hook-up

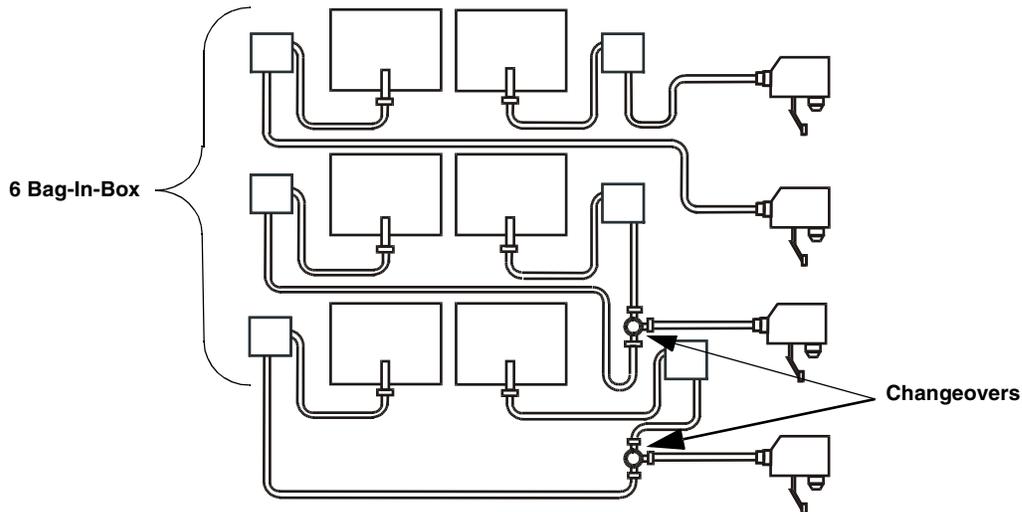
It is possible to tee two BIB containers together and connect these to similar BIB containers with a changeover valve.



To have proper change-over valve operation, do not connect more than three BIB containers together with tees.

Typical connection diagram

In this drawing a four flavor (four valve) BIB setup is shown.



The top shelf has two BIB containers that are each supplying one valve.

The bottom shelf and the middle shelf both contain two BIB containers that are connected together by a change-over valve. Each set of two BIB containers is supplying one valve.

Pump operating pressure

For pump operating pressures please refer to the manufacturer's recommended guideline. Operating pressures are printed on the pump.

Pump mounting guidelines

- Pump should never be mounted lower than the BIB container.
- Do not tee the pump outlet.
- Do not install near high heat.
- Install within 10 ft. of BIB container.
- All connections must be vacuum tight.

PUMP INSTALLATION

- As indicated on the pump, the outlet port is to be mounted up.
- Pumps are to be mounted at the same level or higher than the B-I-B. The best choice is to have the pump above the B-I-B.
- **INLET** tubing from the B-I-B to the pump use; 3/8" I.D. [10mm] minimum, heavy wall (1/8" [3mm]) clear, NSF listed vacuum tubing. Inlet tubing should not have excessive length. Tubing that is allowed to drape down can trap air in the B-I-B creating a potential for pump "sold-out" problems. **The maximum** vertical distance from the bottom of the B-I-B to the pump **must not exceed 5 feet** [1.5 M]. **Maximum** inlet tubing length is 10 ft. [3 M].
- If plumbing multiple B-I-B's to a pump, B-I-B's should be "Teed" **side-by-side** horizontally, rather than one on top of the other (vertically).
- **OUTLET** tubing from the pump to the dispenser should be high pressure rated and NSF listed. Consult "Plumbing Capability" (see page 2) for appropriate tubing I.D.
- Always cut CO₂ and outlet tubing at least 2 ft. [.6 M] longer to provide a "service loop" so the B-I-B rack can be moved for cleaning or service.
- Use new (clean), 1/4" I.D. [6 mm], flexible, high pressure, braided tubing from the CO₂/ air regulator to the pump.

NEVER connect a transfer tank "system" in series with a B-I-B system. Syrup contaminants in old components may work their way through the air supply causing premature failure of the gas pump. Gas used to operate pumps **MUST** be clean and contain no contaminants (syrup, oil, rust, water, etc.). Air compressors may be used with proper particle filters and moisture separators. Air storage tanks should be drained regularly. Pumps subjected to contaminated air are not covered by warranty.

High concentrations of CO₂ can be fatal as it will displace the oxygen from non-ventilated areas. Pumps operated by CO₂ must be in ventilated areas.

If placed in a confined area (basement, closet, cooler box, etc.), exhaust fans capable of changing the room air on a continuous basis should be used.

- All tubing connections must be secured with stainless steel, stepless Oetiker ® clamps.
- Cable-tie all tubing securely to prevent kinks or sags that inhibit performance or cause damage to the pump fittings.

Start-up Procedure

1. Confirm that all tubing connections are properly clamped, fittings are tight, and tubing is not kinked. Install bag connector to the B-I-B.
2. Adjust gas regulator to about 20 psi. [1.4 bar] allowing the pump to stroke slowly.
3. Operate the valve until all air trapped within the tubing has been purged.
4. Once the air has been purged, adjust the CO₂ regulator to the pressure necessary to maintain the desired brix. The most efficient gas usage occurs at 40 psi. [2.8 bar]. **MAXIMUM** static gas pressure to the pump is 85 psi. [5.8 bar], minimum 20 psi. [1.4 bar].

Flowrates that result in a stroke-rate of more than two strokes per second will decrease pump life. (Consult factory) Pump failure due to "overrunning" is not covered by the limited warranty.

To prevent air from entering the system always leave the bag connector attached to the empty B-I-B until a new B-I-B can be installed. Air entered into the system, via air in the bags or vacuum leaks, may cause brix fluctuation, foaming, spitting, non-operation of the vacuum sold-out or pump "run-on" with the valve closed. Symptoms of this kind can lead to a misdiagnosis of the pump.

LESSON 6: BACK ROOM PACKAGE

INTRODUCTION

A Back Room Package is water, syrup, and gas management system with room to store BIB containers.

The water part of the Back Room Packages manages:

- Pressure
- Volume
- Carbonation - optional
- Filtration

The syrup part of the Back Room Package manages:

- Storage Space for BIB
- Space for BIB pumps
- Space for regulators
- Space for extra BIB's and change over valves

PREVIEW QUESTIONS

1. When are back room packages necessary?.....
.....
2. When are water filters necessary?
.....
3. Do back room packages come in different capacities?.....

OVERVIEW

Back room packages are available in 100 G.P.H. or 240 G.P.H. capacities. They are recommended for use in areas with water flow and volume problems. The booster tank maintains and supplies pressurized water to the water filter system. The surge tank supplies filtered water to the carbonator and holds extra volume for times of peak demand.

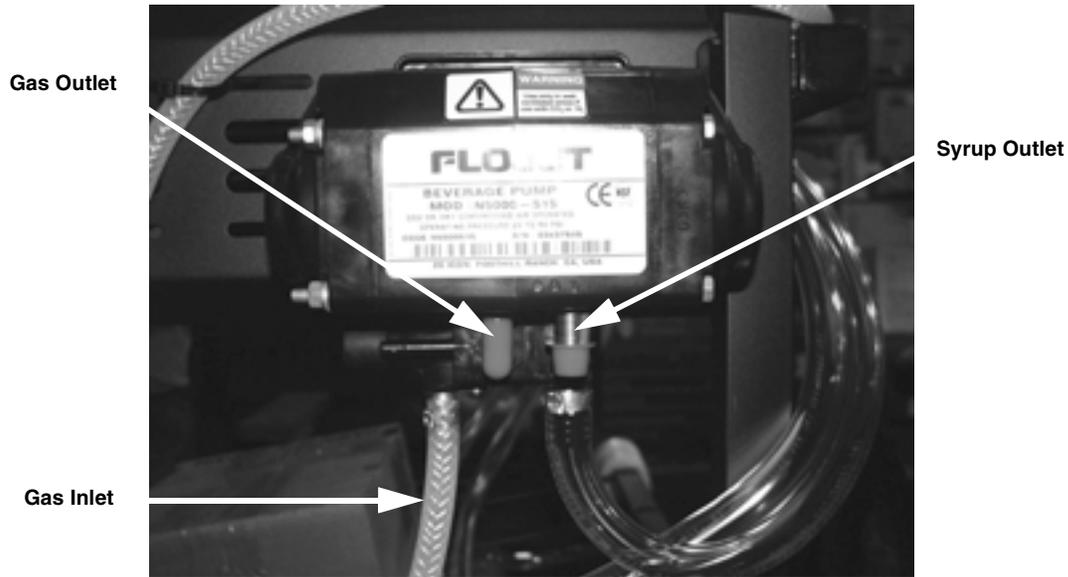
Back room packages can supply treated water at correct pressures for all of your food service equipment, beverage dispensers, ice makers, coffee makers, etc.

The most common models use stackable racks that have space to store syrup boxes, regulators, BIB pumps, change over valves, etc.

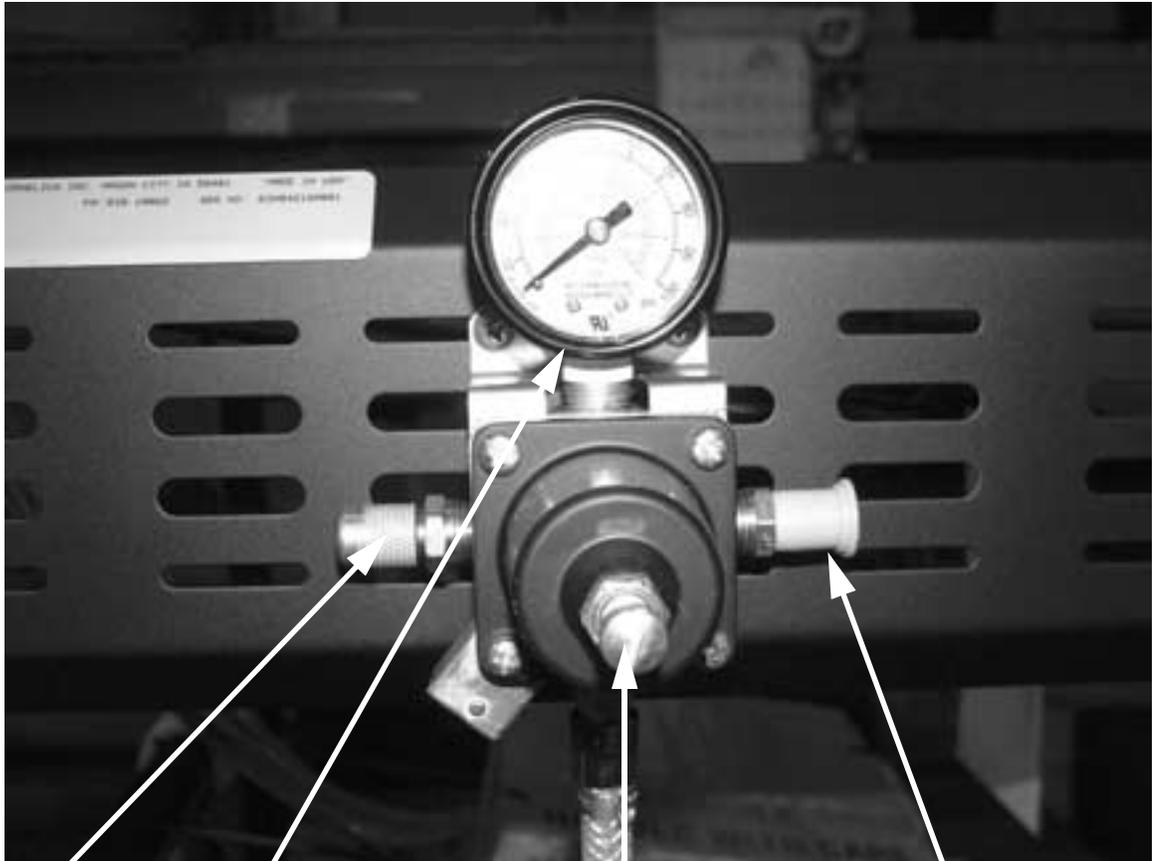
There are wall mounted models if the stackable style is not an option, all models come with or without carbonators.



Water Regulator Pressure Switch Pump and Motor Assembly 100 gph or 240 gph

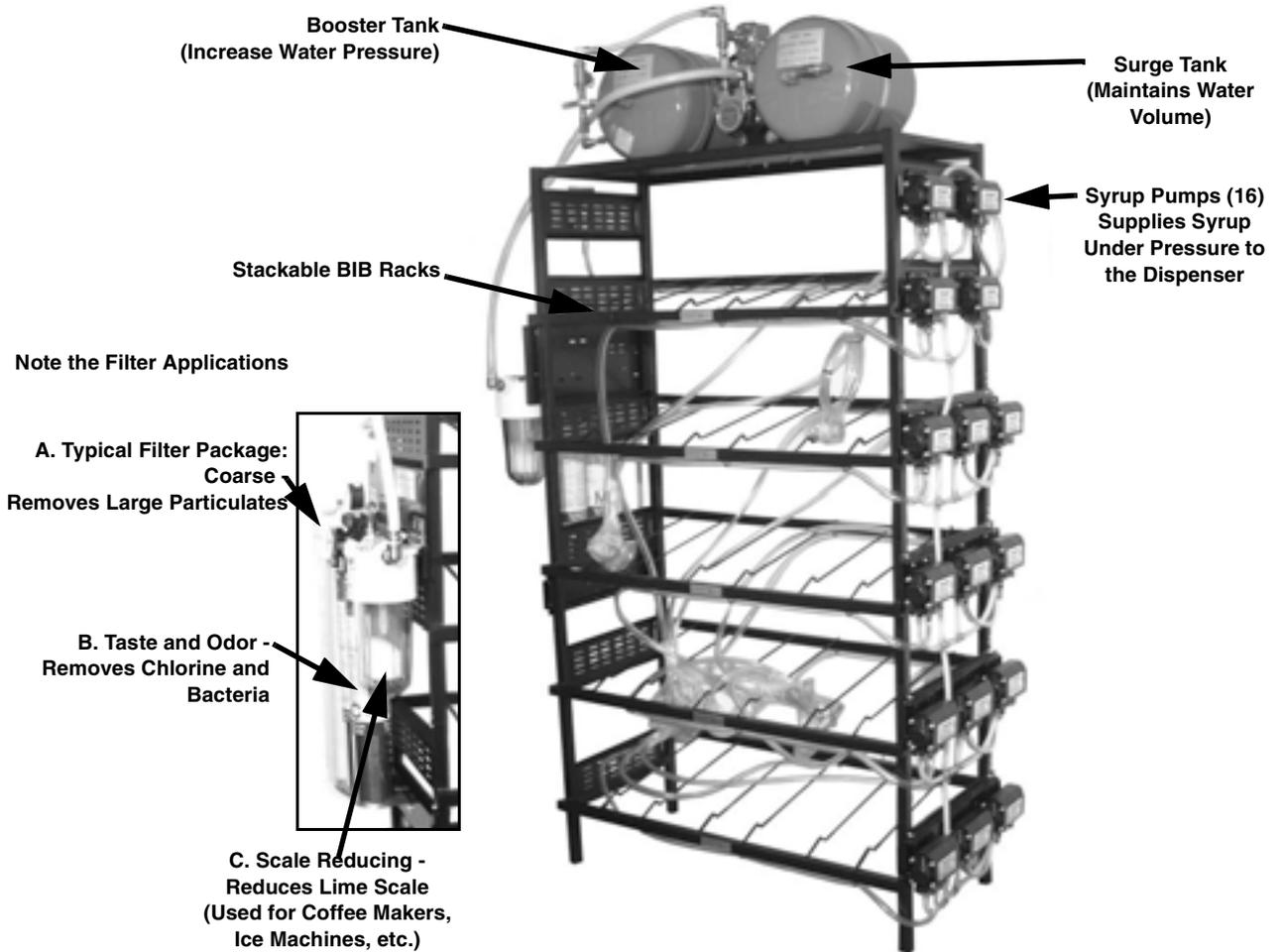


NOTE: Pumps should be mounted at the same level or above the syrup boxes.



Outlet **Regulated Pressure Gauge** **Adjusting Screw** **Inlet**
Secondary CO2 Regulator, Supplies Gas to Maximum Inlet Pressure 200 PSIG Pump
Operate BIB Pumps Operating Range 40 to 80 PSIG

NOTE: The most effective gas usage occurs at 40 P.S.I. but higher pressures will almost always be required due to pressure drop in the lines to the dispensers. Valve flow controls require 30 P.S.I. flowing pressure to regulate properly.



REVIEW

1. Should BIB pumps always be set at 40 P.S.I.?
2. Is it OK to mount BIB pumps lower than the BIBs?.....
3. What is the minimum flowing pressure required at the dispensing valve?.....
4. List four reasons that a back room package would be beneficial?.....

NOTES

LESSON 7: CARBONATORS

INTRODUCTION

Many beverages are made with carbonated water. The efficiency of carbonating water varies from manufacturer to manufacturer, but the principles are similar. When you have completed this lesson on carbonators you will have a better appreciation for the role carbonators play in the serving of a quality beverage.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. What must be known before setting the ideal CO₂ operating pressure for a carbonator?
..... and
2. Inlet water pressure to a carbonator must not exceed?..... psi
3. All carbonators produce carbonated water at the rate of 100 GPH?
..... True False
4. What is the function of the CO₂ connected to the carbonator?

LESSON

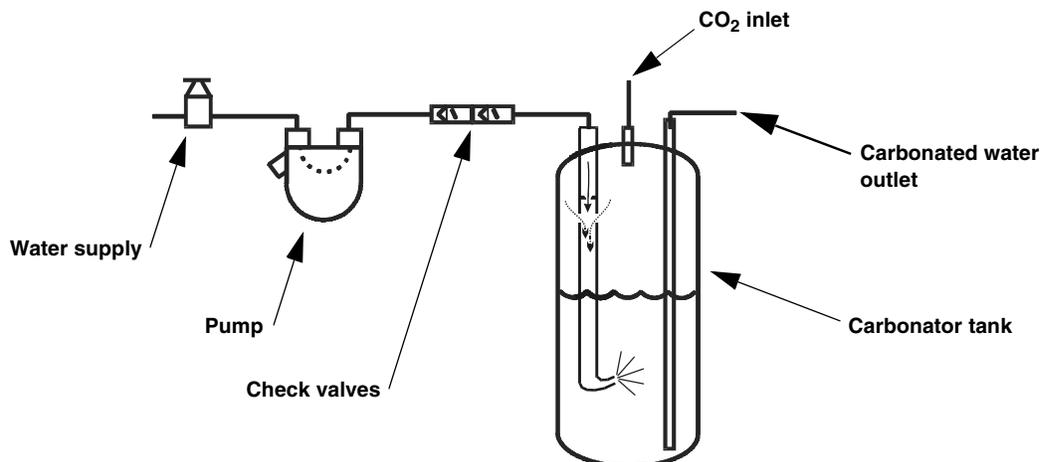
Study the following material about carbonators and answer the questions in the Review section. These questions summarize the most important points in this lesson.

Carbonation can be accomplished in several ways. The simplest way is to merely apply CO₂ pressure to a container of water and the CO₂ will be absorbed by the water.

Although this is easy to do, it is also very slow. Beverage systems require a large volume of carbonated water: consequently, some mechanical means of carbonating water is needed.

The carbonator

A carbonator forces water into a high pressure CO₂ atmosphere speeding up the absorption rate by exposing small droplets of water to the pressurized CO₂.



The illustration shows a simplified diagram of a carbonator.

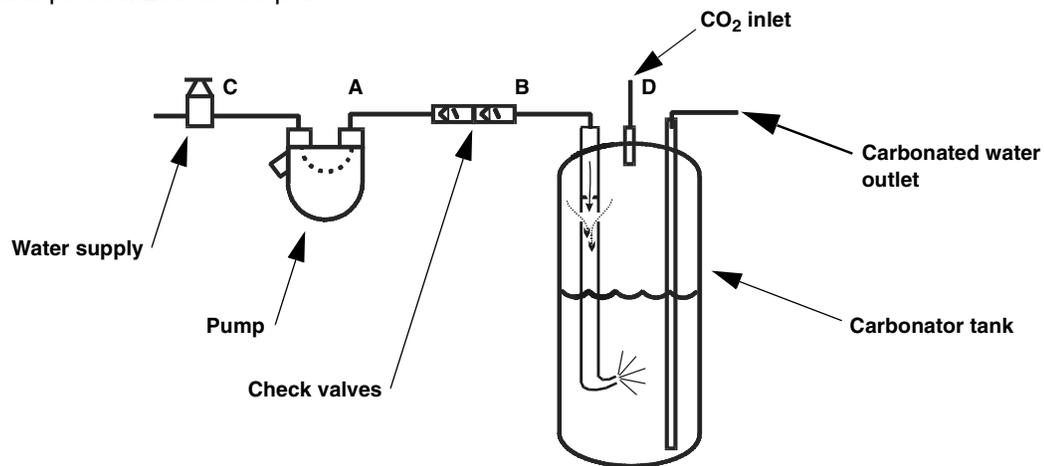
The basics of a carbonator are as follows:

- Tank with CO₂ atmosphere
- Carbonator pump able to deliver the water at a pressure greater than the atmosphere of the tank
- Check valves to prevent carbonated water back-flow

Pressure relationships

The relationships between the various pressures are important. **Note:** The pressures referred to are for example only and not necessarily the pressure to be used in any specific system. In the illustration:

- the water supply pressure should be 70 psi (100 GPH) or less;
- the pump operates at 250 psi bypass;
- the tank is pressurized at 100 psi.



Based on these pressures

- When the pump is not operating, the pressure at Point A is 70 psi water pressure or less, the pressure at Point B is 100 psi CO₂ pressure.
- When the pump is pumping, the pressure at Point B is 185 psi water pressure.

If the pressure differential between the pumping pressure and the tank atmospheric pressure is too low (below 20 psi), the fill time is long and the agitation of the water will not promote rapid absorption of CO₂.

If the tank atmospheric pressure exceeds the pressure from the pump, then no water is pumped into the tank. Ideally the differential is between 30 psi and 60 psi.

If the water supply pressure at point C exceeds the CO₂ atmospheric pressure in the tank at point D, then the water flows into the tank without benefit of the pump and floods the carbonator, ceasing carbonation.

Check valves

The check valves prevent back-flow of carbonated water from the tank into the city water supply. When the pump is not operating, high pressure in the tank will cause the ball to seat against the O-ring and prevent any back-flow of carbonated water into the water supply.

Some carbonators feature a vent-to-atmosphere check valve. Depending on the requirements of local, state, or federal plumbing laws, the vent-to-atmosphere check valve can be located at the inlet to the carbonator or at the inlet to the tank.

Temperature – pressure relationship

In other lessons dealing with carbonation the precise relationship between temperature and pressure is discussed. When setting pressure for a post-mix carbonator, the numbers are not exact because:

- Water quality affects the ability of the water to absorb CO₂.
- Water temperature varies from area to area and sometimes from day to day and even hour-to-hour, and this affects CO₂ absorption.

The post-mix system causes some loss of carbonation.

Pressure settings

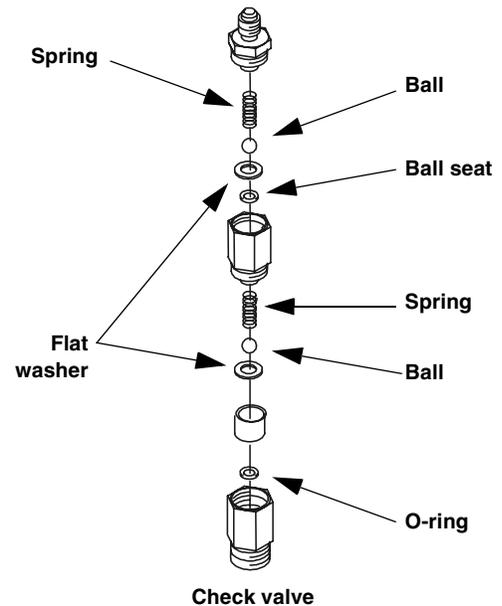
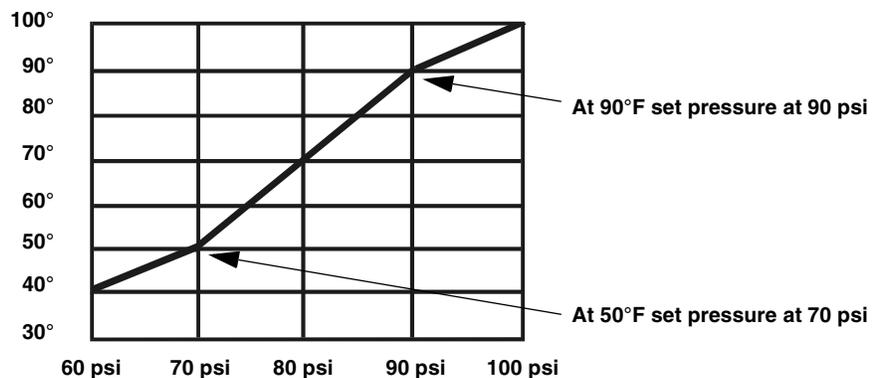
In an area where the water is 50°F or less, start with a pressure setting of 70 psi.

In an area where the water is 90°F or higher, start with a pressure setting of 90 psi.

Internal cold carbonators should be set to a maximum of 65 psi.

After the system is in operation for a few days and has stabilized, check the carbonation. Tests can be done by taste or with a carbonation tester.

The chart is a rough representation of the temperature/pressure relationship to create six to seven absolute volumes. (See Lesson on Carbonation in the Basic Beverage Unit). Adjustments must be made to compensate for the many variables in the system.



Level control methods

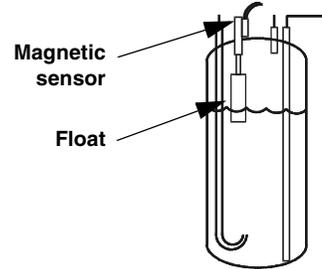
The major methods of controlling the water level in the carbonator tank are as follows:

- Float Switch
- Probe
- Balance Control (weight activated)

Level control methods – float switch

A float contains a magnet located inside a tube extending above the top of the tank. A proximity switch is attached on the outside of the tube and is activated by the magnet inside the tube.

The float moves up and down with the level of the water and moves the magnet accordingly. When the magnet reaches a certain level it activates the water on/off switch.



Float switch level control

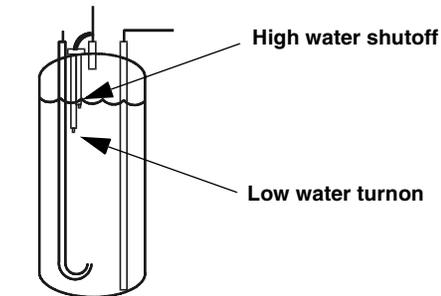
Level control methods – electronic probe control

An electronic probe uses two electrical contacts that are molded into a single assembly at different levels. The high probe is the shutoff point and the low probe is the turnon point.

As the water level drops below the lower probe, the control turns the carbonator pump on to refill the tank.

When the water reaches the high probe the carbonator shuts off.

Basically, when neither probe is in contact with the water, the pump starts. When both probes are in contact with the water the pump shuts off.

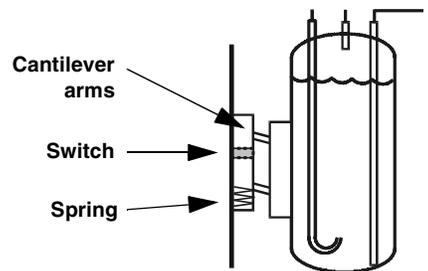


Electronic probe level control

Level control methods – balance control (weight activated)

A balance control tank is mounted with two cantilever arms permitting the tank to move up and down. The tank is held in the UP position by a spring. As the tank fills with water and becomes heavier, the tank moves downward until the switch stops the flow of water.

As water is drawn off the tank, it becomes lighter and the spring forces it upward until the switch starts refilling the tank.



Balance level control

Using multiple carbonators

Frequently one carbonator is unable to keep up with the demands of a beverage system. Separate carbonators can be used for separate dispensers in the system or multiple carbonators can be plumbed together to increase the supply. Another option is a carbonator with a larger tank capacity.

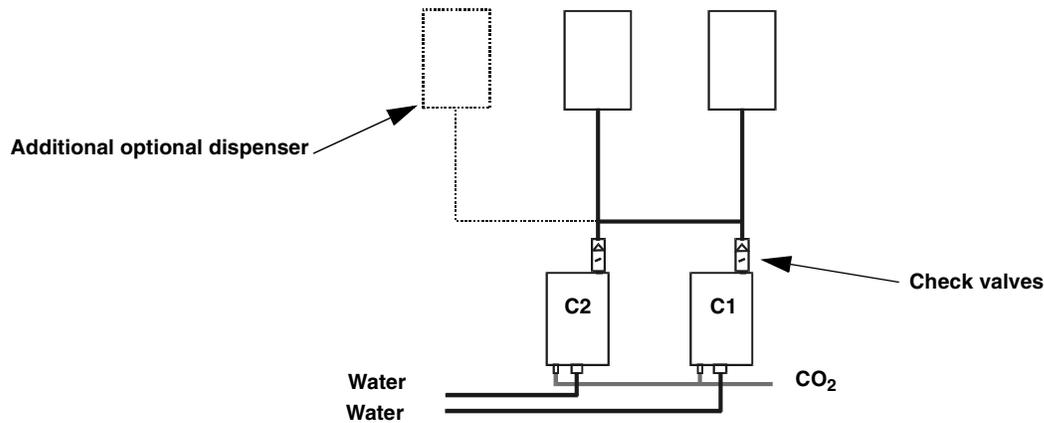
There are advantages in using multiple carbonators:

- Production capacity is increased because more than one carbonator is producing carbonated water.
- Reserve capacity is increased by having more than one tank supplying carbonated water.
- If one of the carbonators becomes non-operational, only partial capacity is lost.

NOTE: Two carbonators connected in parallel, supplying carbonated water to two dispensers is a preferred configuration. If one carbonator stops working, only half the capacity is lost. If the two

carbonators are each connected to two dispensers, one carbonator going out would shut one dispenser down.

In the diagram the two carbonators (C1 & C2) are plumbed together.



Important features of this plumbing configuration are:

- The check valves at the outlets ensure that one carbonator will not back-flow carbonated water into a second carbonator.
- The two carbonators are connected directly to dispensers and connected together with the bypass. This ensures maximum flow rates to the dispensers and allows one carbonator to feed both dispensers if a carbonator malfunctions. An additional dispenser could be added as shown.
- Separate water lines are used to ensure adequate supply for each pump.
- A single CO₂ supply equalizes the pressure to the carbonators. This further prevents any carbonator being dominant. However, if the CO₂ usage is very high and the regulators are “frosting over,” then separate supplies have to be used.

How much and how long

The amount of carbonated water that a carbonator can supply is based on the capacity of the tank and the flow rate of the pump.

Example: A tank holds 60 ounces and the flow rate of the pump is 100 GPH (3.55 oz./sec.). Next look at dispensing. If one valve is dispensing at 4.5 ounces/second, that means that the water portion of that drink (assuming a ratio of 5:1) is 3.75 oz./sec. This valve flow rate is slightly greater than the pump flow rate: $3.75 - 3.555 = .20$ oz./sec. Therefore the 60 oz. reserve will be consumed at the rate of .2 oz./sec. and the reserve tank will last for 300 seconds or 5 minutes.

The Carbonator Capacity Chart shows the relationship between multiple valves and carbonators. This chart uses the Cornelius VA13 carbonator and the Cornelius UF-1 valve for these examples. The results are expressed in ounces that can be poured before the carbonator goes empty.



Carbonator Capacity Chart

Pourable Ounces Before Carbonator is Empty				
No. of UF-1 Valves Pouring @ 4.5 Oz./Sec.	One VA 13 Carbonator	Two VA 13 Carbonator	One Large Reserve Carbonator	Two Large Reserve Carbonators
1	1384 oz.	2770 oz.	4961 oz.	9923 oz.
2	136* oz.	273 oz.	490 oz.	980 oz.
3	105* oz.	210* oz.	377 oz.	754 oz.
4	94* oz.	188* oz.	338* oz.	676 oz.
* Recommended that an additional carbonator be added or a larger capacity be used.				

The pourable ounces shown are based on a continuous pour. As an extreme example: Four valves pouring at the rate of 4.5 oz./sec., with two large reserve carbonators, you must dispense 676 ounces before emptying the carbonator tanks.

In normal operation there is a pause between pours to set a new cup in place. This will add to the pourable ounces.

The carbonator pump

The industry standard pump used in carbonators is rated at 100 GPH. However, some carbonator models have been manufactured with 200 GPH pumps. Some builders have used pumps with a lower flow rate and although these carbonate well, they do reduce the rate at which carbonated water is made.



REVIEW

1. The simplest way to carbonate water is?
2. In order to enter the carbonator tank, water must be at a pressure (greater / less) than the tank atmospheric pressure.
3. To have an acceptable fill time, the pressure differential should be between psi and psi.
4. An electronic probe uses electrical contacts that recognize high water and low water.
5. What is a possible solution for a beverage system that doesn't produce enough carbonated water?
.....
.....
6. The amount of carbonated water that a carbonator can supply is based on the capacity of the tank and the

LESSON 8: COOLING UNITS

INTRODUCTION

Cooling units are an important system in the development of quality beverages. After completing this lesson you will understand the different types of cooling units and the function of the individual cooling system components.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. What are two basic types of cooling systems?
2. What is the purpose of an ice bank?
3. In ice cooled systems the cold plate is made of?

LESSON

Study the following material about cooling units and answer the questions in the Review section. These questions summarize the most important points in this lesson. Cooling units are of three distinctive types: electric cooled dispensers, ice cooled dispensers, and remote dispensers.

Electric cooled dispensers

Countertop dispensers sit on the counter and are electrically cooled. A refrigerant is pumped through the system entering the compressor as a low-temperature, low-pressure gas and discharging into the condenser as a high-pressure, high-temperature gas. As the hot gas passes through the condenser, room air is blown over the coils, cooling the refrigerant which condenses into liquid. A metering device removes pressure and regulates the flow. The refrigerant next passes through the evaporator where it changes from a liquid to a gas, absorbing heat from the surrounding water. This causes an ice bank to form. The refrigerant then returns to the compressor to begin the cycle again.

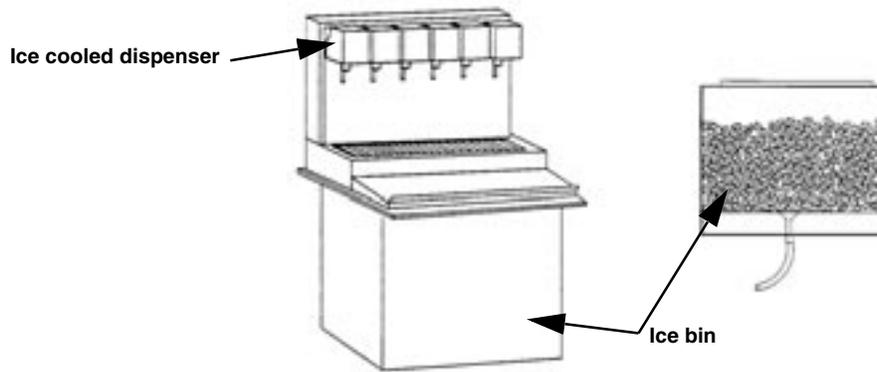
The evaporator sits in a square water bath. An ice block forms around the evaporator and an agitator provides continuous movement of the water. The water is continually taking heat from the syrup and water coils that wind through the bath. At the same time the water is cooled by the ice block formed by the refrigeration system. The size of the ice block is controlled by the ice bank control. When the control is surrounded by ice, it shuts off the refrigeration system. The ice bank control is the primary source of refrigeration failure.

This form of refrigeration is called "drop in" since the system is set in the counter. In case of repair the entire refrigeration deck can be swapped out and repair can take place off site. Alternately, individual parts can be repaired on site since the ice bank provides cooling for some time even without the system running.

Ice cooled refrigeration

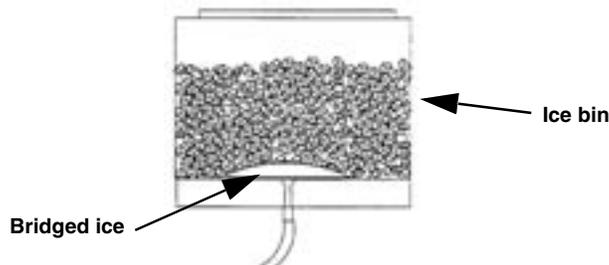
Ice cooled refrigeration units are the simplest because there are few moving parts. The syrup and water run through stainless steel coils that are embedded in a 4- to 6-inch thick aluminum cold plate. Ice is placed on top of the cold plate, which transfers heat out of the product coils and results in melting ice. After passing through the cold plate, the product tubing is continuously insulated up to the dispensing valves.

NOTE: Ice drink units have an agitator to keep ice on the cold plate and also to dispense ice into cups.



The ice (cubed) needs to be warmed and broken up before adding to the ice chest. If the ice is too cold it will freeze the product in the coils.

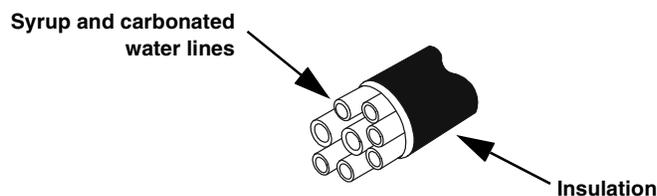
Cold plates only work properly if they are in contact with ice. If there is water in the bottom of the ice chest, the product will not become cold enough. Standing water is often a result of kinked drains (replace with rigid PVC if necessary). Another reason for improper cooling is ice bridging. Ice in contact with the cold plate melts and drains normally. However, the ice above does not fall onto the plate. This can be caused by low usage and can be prevented by periodically pushing the ice down into the bin.



Remote refrigeration

Remote refrigeration systems separate the refrigeration system from the dispensing valves. They function like the electrically cooled countertop versions, but are used when a large-capacity system is required. Remote systems save counter space.

Because the syrup and carbonated water lines can be very long in a remote system, it is important to wrap them in heavy insulation. Remote systems also employ a recirculating pump. The pump recirculates carbonated water through the cooling coil in the water bath and then through tubing to the syrup lines returning it to the cooling coil. The recirculating pump must be stainless steel since carbonated water in contact with copper or brass will produce nausea.





REVIEW

1. Why is standing water in the ice bin a problem?
.....
.....
2. What is ice bridging?
.....
.....
3. What happens in the condenser of an electric cooled refrigeration system?
.....
.....
4. What happens in the evaporator?
.....
.....
5. Why doesn't the water bath freeze solid?
.....
.....
6. Why is the refrigeration unit separated from the dispensing valves in a remote system?
.....
.....
7. Why is insulated tubing used in a remote system?
.....
.....

LESSON 9: DISPENSING VALVES

INTRODUCTION

Dispensing valves are a very important part of any post-mix system. When you have completed this lesson you will understand some fundamentals that apply to all valves.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. Name two major functions of a post-mix valve.
2. The flow rate of the water is always controlled by a fixed rate device. True False
3. The syrup flow rate is?
4. Water to syrup ratio is tested using a or a
5. All products have a syrup to water ratio of 5:1. True False

LESSON

Study the following material about dispensing valves and answer the questions in the Review section. These questions summarize the most important points in this lesson.

Valve functions

Post-mix valves control:

- the ON-OFF of syrup and water,
- the flow rates of syrup and water,
- the mixing of the two ingredients as they pour into the cup, and
- in some instances - portion dispensed control.

NOTE: Although some valves have a high flow rate – up to 4.5 oz./sec., adding fast flow capacity valves will not make up for inadequate supplies of cooled water and syrup.

How are water and syrup flow rates controlled?

There are three methods of controlling flow rates:

- A fixed rate flow control washer (water only).
- An adjustable flow control (syrup & water).
- An adjustable needle or gate valve.

The fixed rate flow control washer and adjustable flow control are used most often.

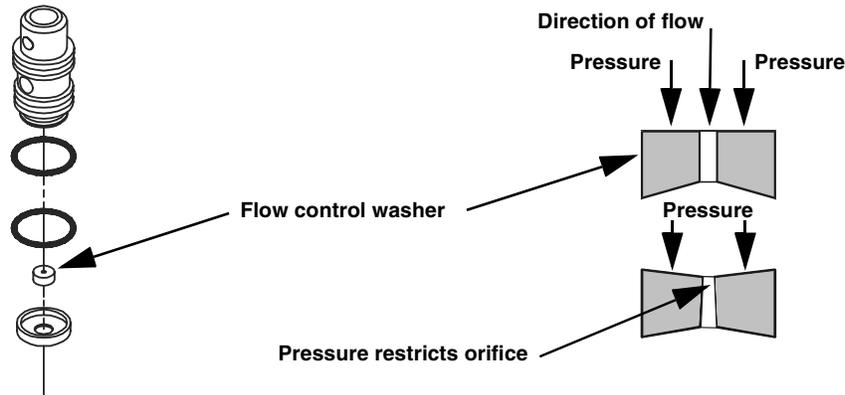
The needle valve or gate valve is seldom used because it cannot compensate for variations within a system. The various components that make up these controls are shown below.

Flow control washer (water only)

The flow control washer is designed so the pressure of the water against the surface of the washer will regulate the size of the orifice through the washer.

For example, if a washer is designed for 2.0 oz./sec., pressure against the face of the washer will cause the orifice size to be reduced. The size of the orifice will be the correct size to permit a 2.0 oz./sec. flow

through the washer at the applied pressure. If the water pressure is reduced, the orifice will increase in size and the flow rate will remain at 2.0 oz./sec.



Water flow control washers are non-adjustable and work well within a limited pressure range. They are not exact enough for some situations however.

Adjustable flow control

The components shown are present in most adjustable flow controls. The exact size and appearance may vary slightly.

The piston may vary in size from valve to valve but the function is always the same. The size of the orifice in the piston varies depending on whether the piston is used for syrup or water, and whether it is fast flow or ultra flow.

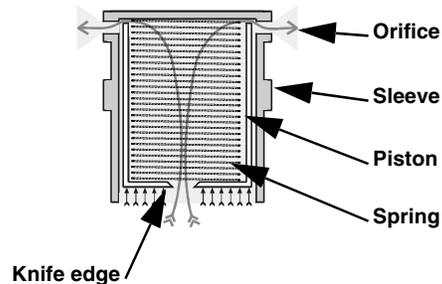
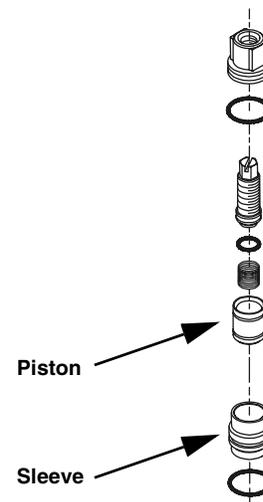
The inlet orifice is a knife-edged orifice because there is no pressure drop through a knife-edged orifice. This is important when metering the flow of syrups where viscosity varies. If the viscosity varies, the flow rate through the knife-edged orifice remains constant as long as the pressure remains constant.

In operation the liquid flows through the knife-edged orifice in the bottom of the piston and then out the orifices in the sleeve.

The outlet orifice opening size in the sleeve is regulated by the position of the piston. In the illustration, the piston is restricting most of the outlet orifices.

The position of the piston inside the sleeve is determined by the upward pressure of the liquid against the base of the piston and the downward pressure of the spring inside the piston (not shown here). The pressure of the spring is regulated by the adjusting screw.

If the pressure of the liquid increases, the flow rate through the knife-edged orifice will increase. The piston is moved upward closing off more of the outlet orifices. The same flow rate is thereby maintained.





Adjusting flow rates

Flow rates of the water and syrup are adjusted based on the desired ratio. For example: if the desired ratio is 5:1, then the flow rate of the water is 5 times that of the syrup.

If the desired finished drink flow rate is 3.0 ounces per second, then the water flow rate is 2.5 oz./sec. and the syrup flow rate is 0.5 oz./sec. (The water at 2.5 oz./sec. is five times the 0.5 oz./sec. syrup flow rate.)

Flow Rates oz./sec. Based on 5:1 Ratio		
Finished Drink oz./sec.	Water oz./sec.	Syrup oz./sec.
1.5	1.25	.25
2.0	1.67	.33
2.5	2.08	.42
3.0	2.5	.50
3.5	2.92	.58
4.0	3.33	.67
4.5	3.75	.75

Calculating flow rates

The most frequent ratio is 5:1. There are charts available listing the breakdown for many ratios and flow rates. It is useful to be able to calculate flow rates when a chart is not available.

An example of calculating the water and syrup flow rates given the finished drink flow rate and the water to syrup ratio:

Given:

1. Finished Drink Flow Rate = 3.0 oz./sec.
2. Water to Syrup Ratio = 5 to 1

To calculate Water Flow Rate:

1. Calculate the Total Portions = Water Portion + Syrup Portion
(example $5 + 1 = 6$)
2. Calculate Syrup Flow Rate = Finished Drink Flow Rate \div Total Portions
(example $3.0 \text{ oz./sec.} \div 6 = .5 \text{ oz./sec.}$)
3. Calculate Water Flow Rate = Finished Drink Flow Rate - Syrup Flow Rate
(example $3.0 \text{ oz./sec.} - .5 \text{ oz./sec.} = 2.5 \text{ oz./sec.}$)

Prove the calculation is correct by adding water flow rate of 2.5 oz./sec. + syrup flow rate of .5 oz./sec. = finished drink flow rate of 3.0 oz./sec.

Water flowing at 2.5 oz./sec. and syrup flowing at .5 oz./sec. achieves a ratio of 5:1 and 3.0 oz./sec. flow rate.

Setting the flow rates - water

When setting flow rates, always follow these steps:

- Determine the desired flow rate for the finished drink. Be sure the dispenser is capable of this flow rate.
- Calculate the portion of the total flow that will be water and adjust the water flow to that setting.
- Using a ratio cup, adjust the syrup flow rate to the proper ratio.

Flow rates are adjusted by turning the adjusting screw on the flow regulator clockwise for a greater flow and counterclockwise for less flow. Repeated tests will usually be required to reach the correct amount of water.



Many electric valves can be adapted to use a timer that will operate the valve for a set period of time, usually 2 seconds. Using the previous example, the set 2-second period of time equals 8.0 ounces of water. Using a timer gives you an accurate, repeatable period of time.

Any graduated beaker or ratio cup can be used to measure the water.

NOTE: Once the water flow rate is set, it should never be changed unless a new finished drink flow rate is desired. **NEVER use the water flow rate adjustment to adjust the ratio.** If the valve being adjusted has a lock nut on the adjusting screw, lock it.

If the ratio setting varies, most often it is a result of changes within the syrup system. If repeated adjustments to the syrup flow rate are necessary, the pressures should be checked and the system should be checked for restrictions. It is probably time to clean and sanitize the syrup tubing and cooling coils.

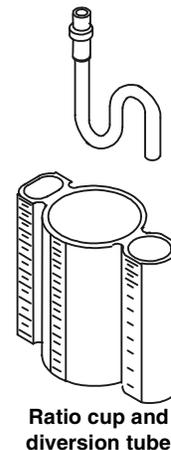
Setting the flow rates - syrup

Actual procedures are specific to each valve model.

Setting the water flow rate and adjusting the syrup for the desired ratio gives the most accurate syrup flow setting possible. Measure the ratio and adjust the syrup flow based on proportion cup results.

There are two styles of proportion cup. With one style the ratio is correct when the syrup and water levels are equal. The ratio is marked on the syrup compartment. With the other style proportion cup the ratio is read at the syrup fill level. When using a proportion cup always take these precautions to ensure accuracy:

- After installing the separator tube, open the valve to fill the syrup tube.
- Clean the cup thoroughly between tests so there is no carry-over from one test to the next.
- Fill the cup to approximately 3/4 full and use approximately the same quantity for each test to ensure consistency.



Ratio cup and diversion tube

REVIEW

1. Post-mix valves can control portion size. True False
2. Which two controls are used most often for water and syrup flow rate control?
.....
.....
3. If a desired ratio is 5:1, then the flow rate of the water is times that of the syrup.
4. To test the water flow rate you will need an accurate timer and?

NOTES

LESSON 10: INSTALLATION GUIDELINES

INTRODUCTION

Proper installation is critical to proper operation of any piece of post-mix equipment. After completing this Lesson you will have a better appreciation for the basic principles of equipment installation.



PREVIEW QUESTIONS

Check your current knowledge by taking a few minutes to answer the following questions:

1. Does dispensing equipment need grounding?
2. How can you keep track of which product is in a syrup line?
3. How must CO₂ tanks be placed?

LESSON

Study the following material about installation and answer the questions in the Review section. These questions summarize the most important points in this lesson.

General installation guidelines



IMPORTANT - It is the responsibility of the Installer to comply with all federal, state, and local regulations concerning the electrical and plumbing connections of any beverage dispensing equipment.

Consult equipment installation manual for necessary clearance space. In general there needs to be space all around for ventilation. Clearance must also be provided for removing equipment panels and hoods, lifting cooling systems out of counters, and providing service and repair.

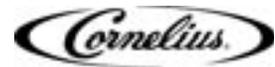
Post-mix unit bases must be sealed to the counter top and all access holes to the base sealed with permagum. An alternate to sealing is to install four legs elevating the unit off the counter. Counter tops must be able to support the weight of the installed equipment.

Electrical requirements

Verify that the proper voltage, hertz, phase and amperage is available within 5 feet (UL requirement) of the dispenser to be installed. Refer to equipment nameplate for requirement specifics. All units must be electrically grounded to avoid possible electrical shock to operator.

Plumbing requirements

- Water supply must be located within 5 feet of the unit to be installed.
- Gallon-per-hour flow rate must be 100 GPH for each carbonator to be installed.
- Water pressure over 70 psi requires installation of a water pressure regulator. Water flow of at least 3-½ oz./sec. (100 gal./hr.) is necessary for pump operation.
- Water filters are recommended but not required.
- If required, a floor drain must be in place prior to the installation and located within 6 feet of the unit to be installed. In accordance with state and local laws, floor drains must have an air gap or an approved vacuum breaker to protect against back-flow.



Installing a syrup system

Tank

Syrup tanks should be placed in an easily accessible, yet out of the way location. Placing the tanks off the floor allows for mopping of the area. The tanks may also be placed on a storage platform.

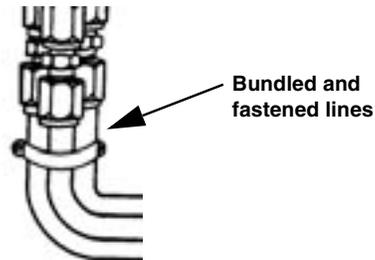
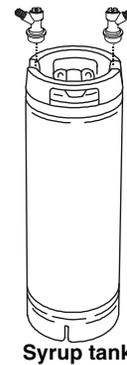
Using ¼ inch tubing, assemble CO₂ lines to push syrup from the tanks. CO₂ lines connect the outlet side of the secondary regulator to the syrup tanks.

Identify the flavor of each line with a tag.

Bundle and fasten lines that are longer than three feet allowing slack for changing tanks.

Assemble tubing to connect the syrup tanks to the dispensing unit. Select the proper sized tubing based on the chart. Work from the tanks toward the dispensing unit trimming excess tubing when the dispenser is installed. Bundle and fasten lines to a solid surface.

Label both ends of the lines to avoid confusion.



Required Tubing Size		
Standard System Distance (tanks to dispenser)	Recirculating System Distance (tanks to dispenser)	Tubing Size (i.d.)
1 – 50 ft.	1 – 20 ft.	1/4 inch
51 – 250 ft.	21 – 100 ft.	3/8 inch
	101 – 250 ft.	1/2 inch

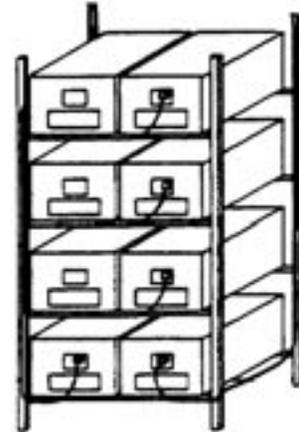
Bag-in-Box (BIB)

Syrup boxes should be placed in an easily accessible yet out of the way location. Placing the boxes off the floor allows for mopping of the area. The boxes may be placed on a storage rack. Bag-in-Box pumps must be mounted nearby, on a solid surface, and level with or above the boxes.

Using ¼ inch tubing, assemble CO₂ lines to connect the outlet side of the secondary regulator to the syrup pumps. Bundle and fasten lines that are longer than three feet allowing slack for changing tanks.

Assemble tubing to connect the bag-in-box pump to the dispensing unit. Select the proper sized tubing based on the tubing sized chart. Leave enough slack at the pump end to allow pumps to be removed. Work from the syrup pumps toward the dispensing unit trimming excess tubing when the dispenser is installed. Label both ends of the lines to avoid confusion.

See “Pump Installation” on page 23.

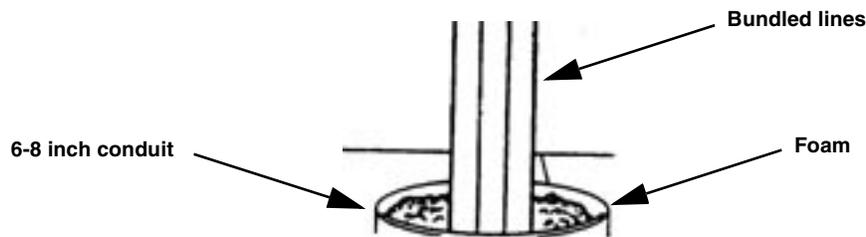


Syrup installations

In order to run tubing through the floor, it must go through conduit. The conduit must have a 6-inch minimum i.d. (an 8-inch is recommended.) Seal the conduit with foam to prevent leaks from traveling through the floor.

All changes in tubing direction should be made with 24-inch sweep bends. Factory elbows are not acceptable.

Follow all state and local laws concerning routing tubing above a suspended ceiling and through a firewall.



Installing a CO₂ system

CO₂ can be stored in low pressure or high pressure cylinders. Low pressure cylinders typically hold 200 or 400 pounds of CO₂ and are permanently installed and refilled on site. High pressure cylinders typically contain 10, 20, or 50 pounds of CO₂ and are returned for refilling.

CO₂ tanks must be placed in a vertical position. Select a tank location site that allows for access to the shut off valve. Install one end of a safety chain to a solid structure with an eyebolt at a height two thirds of the distance from the base. Attach an S-hook or chain clip to the opposite end of the chain. Use enough chain to fit loosely around the tank allowing for easy tank replacement.

CO₂ safety

High pressure CO₂ cylinders must be handled with care. The internal pressure is very high, up to a maximum 1800 psi.



CAUTION - When the cylinder is not in use always keep the cylinder valve closed to prevent any moisture from entering the cylinder. Any moisture in a CO₂ cylinder can cause carbonic acid to form and corrode the cylinder walls. Corrosion can reduce the wall thickness and the cylinder can rupture.



WARNING - Always secure the cylinder so it cannot be knocked over. If a cylinder is knocked over, the valve can break and the cylinder will become an unguided missile. Serious and possibly fatal injuries can occur.



DANGER - CO₂ displaces oxygen. Strict attention must be observed in the prevention of CO₂ gas leaks in the entire CO₂ and beverage system. If a CO₂ gas leak is suspected, particularly in a small area, immediately ventilate the contaminated area before attempting to repair the leak. Personnel exposed to a high concentration of CO₂ gas will experience tremors that are followed rapidly by loss of consciousness and suffocation.



Installing a carbonator

Select a position that will allow the carbonator to be level and horizontal so that the level sensing switch will operate correctly. The location should have good access for both installation and future service needs. In particular the carbonator pump must be readily accessible. Installing a shelf sometimes is a good solution to access requirements.

The location also needs a ½ inch cold water supply with shut-off valve within six feet. A standard wall outlet electrical supply with a 20 Amp circuit breaker needs to be within three feet.

Water, CO₂, and carbonated water lines must be installed. A 3/8-inch water supply line connects the water source to the inlet of the carbonator pump. A ¼-inch line connects the high pressure regulator to the CO₂ inlet fitting on the carbonator tank. And, a ¼-inch or 3/8- inch line (depending on system flow rate) carries the carbonated water from the carbonator to the dispenser.

These lines must be labeled, bundled and anchored to solid surfaces.

In order to run tubing through the floor, it must go through conduit. The conduit must have a 6-inch minimum i.d. (an 8-inch is recommended.) Connect the stainless steel tubing to the plastic tubing with adapters. Put a double bend in the stainless lines and seal the conduit with foam to prevent leaks from traveling through the floor.

Installing a cooling system

Footprint

Before cutting into the counter:

- Make sure there is enough space for the unit.
- Make sure the counter will support the combined weight of the equipment.
- If you are installing a drop in make sure there is clearance between the counter top and the floor to accommodate the unit.



Ice cooled

Cut the counter top to accommodate the portion of the ice chest that will be below the counter. Spread a bead of silicone on the edge of the counter and carefully lower the ice chest into the prepared hole. Dispensing equipment must be sealed to counter top for sanitation reasons.

Connect one-inch PVC drain lines. After checking for leaks insulate to prevent condensation.

If necessary mount the transformer on the wall and connect.

Complete the syrup/concentrate tubing connections. The excess tubing will be at the dispenser end so trimming will be necessary. Be sure to connect each line to the product for which it is labeled.

Electrically cooled

Decide on the counter location for the unit and place it carefully. Remove the splash plate and drip tray to mark the opening for the tubing. Cut the counter top opening. Spread silicone sealer on the bottom of the dispenser and place carefully on the counter.

Remove the hood. Install the drain line and drip tray.

Fill the dispenser water bath until water spills out the overflow. Connect to the electric supply to start forming the ice bank.

Complete the syrup/concentrate tubing connections. The excess tubing will be at the dispenser end so trimming will be necessary. Be sure to connect each line to the product for which it is labeled.

Remote cooling

Position refrigeration unit for good access to all areas that may need service. When selecting a location also keep in mind access to water and electricity. Mount the unit on the stand if included. Connect the refrigeration unit to the electrical supply leaving switches turned off. Level the unit.

Fill the water bath until water spills out the overflow. Turn on the refrigeration and agitator switches to start forming the ice bank.

Next install the dispensing tower. Cut the openings in the counter. Apply a bead of silicon between the tower and the counter and fasten with screws. Mount the transformer and connect.

Flush the water supply line and connect to the water inlet on the carbonator pump. Install a ¼-inch line from the CO₂ to the carbonator. Connect the trunk line between the refrigeration unit and the dispensing tower. Label the product on both ends of each line. Anchor the trunk line with brackets to prevent the lines from kinking or being damaged.

If more than one tower is involved in the setup, assemble the carbonated water circulating system in series not parallel.

REVIEW

1. How should the pumps be positioned with respect to the bag-in-box?
2. Why is silicone used in installation of dispensing equipment?
3. Why must a CO₂ cylinder be chained?
4. What must be considered when selecting a location for a carbonator?
5. What should be considered when selecting a position for a remote cooling unit?



SITE ASSESSMENT SECTION

WATER SYSTEM

- Filters: Coarse? ____ Taste/Odor? ____ Scale Inhibitor? ____
- Is water main ½ inch I.D. minimum? ____
- Pressure Static? ____
- Pressure Flowing? ____
- Length of run? ____
- Shut off valve? ____
- Back flow prevention? ____
- Is water softened? ____
- Is water line connected to a water heater? ____
- Perform water test to insure that the minimum flow and pressure requirements are met or exceeded.

SYRUP SYSTEM

- Is there adequate space available for the number of boxes required to supply all valves?
- Is there room for extra boxes and change over valves?
- Is there space to mount the syrup pumps level with the boxes or above them?
- Distance between the boxes and pumps should not be greater than 10 feet, vertical rise should not be more than five feet.
- Minimum tubing size between the pumps and unit is 3/8 I.D.
- Syrup viscosities are affected by temperature 50 degree ambient or above is recommended.
- Some units require higher flowing pressures than others (e.g. The Pinnacle F C B requires 45p.s.i.g. flowing pressure at the unit.)

If you suspect syrup supply problems, tee a pressure gauge into the supply line just before it enters the unit. Start the Blendonator and read the pressure gauge while the product pump is running, the gauge should not drop below 45p.s.i.g. if the flowing pressure is adequate.

BACKUP CO2 FOR BULK SYSTEM

- Bulk tanks require Secondary Regulators; maximum inlet pressure should not exceed 200 p.s.i.g.
- High pressure tanks require Primary Regulators; inlet pressure must be 500 p.s.i.g. minimum.
- Supply lines longer than 100 feet require 3/8 ID tubing.
3/8 tubing should be used on all new installations.

ELECTRICAL SYSTEM

- Is there a dedicated electrical circuit for each of the dispensers or ice makers?
- Is there an outlet within 6 feet of the dispenser or ice maker?
- Is the outlet polarity correct with a good ground connection?

COUNTER

- Are the counters large enough for the unit foot print, considered power cord, supply lines and Air flow if applicable?
- Will the counters support the weight of the dispenser and ice maker?
- If the unit is an ice cooled drop in, is there room between the counter top and the floor for the ice bin?

TEST SECTION

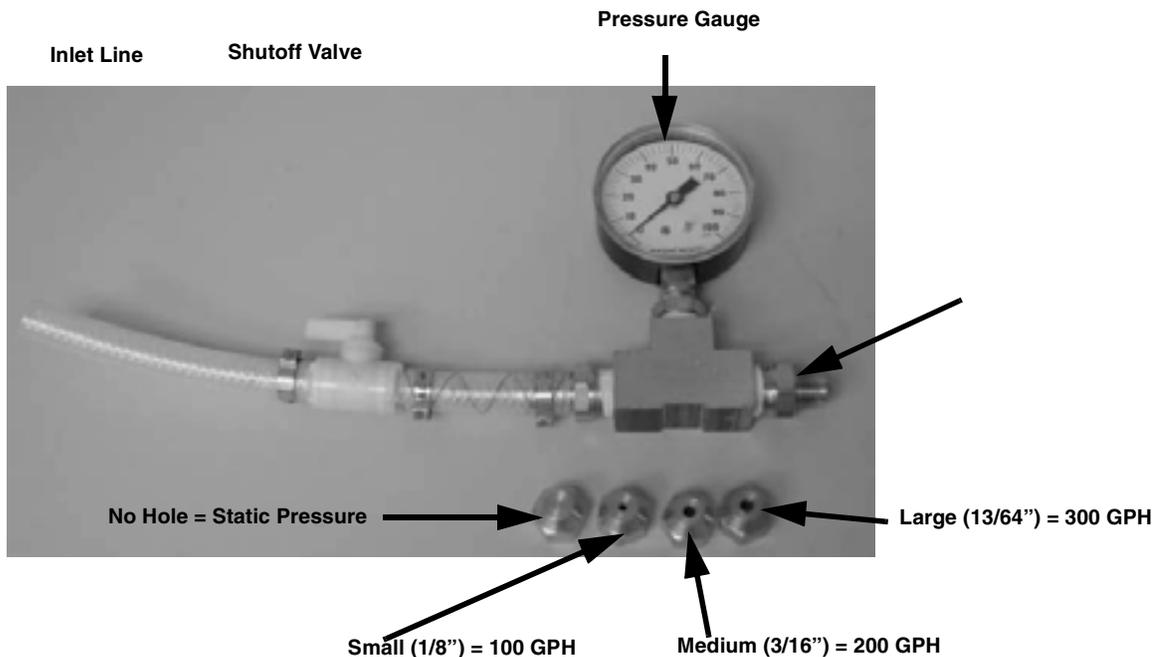
Water pressure & volume test:

Estimate the water usage of all equipment connected to the water delivery system (e.g. Intellicarb = 125 G.P.H. a two Fl. Pinnacle = 100 G.P.H. Total = 225 G.P.H.) Select the 13/64 orifice to insure that you can supply more than the 225 G.P.H. Required to operate both units.

Connect the IMI Cornelius water test device to the supply line that will be connected to the unit.

Select the correct orifice for the static or flowing pressure that you need to verify.

Turn on the water supply, open tester shut off valve and allow the water to flow into a drain or bucket for at least 20 seconds, read the pressure gauge while the water is still flowing, or just take the gauge reading if static pressure is being checked.



If the gauge is reading 25 PSI or higher with the 13/64 orifice installed you are flowing at 300 GPH or more.



Static Pressure = 60 psig



Low Water Volume = less than 25 psig



Proper Water Pressure
Volume = greater than 25 psig

ELECTRICAL TEST

Receptacle Test

- Open ground - Ground contact not connected.
- Open neutral - Neutral contact not connected.
- Open hot - Hot contact not connected.
- Hot and ground reverse - Hot and Ground contacts interchanged.
- Hot and Neutral reversed - Hot and neutral contacts interchanged.



Volt/Ohm Meter

Check the following:

- Voltage at receptacle.
- Correct voltage range.

Used to troubleshoot the unit and components.



