



Product Manual

Bulk CO₂ Storage Systems
Carbo-Max[®] 600 - 750 Series
Carbo-Mizer[®] 300 - 750 Series
NSF Certified



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Revision Log

Revision Level	Date	Description
A		Original

Preface

General

The innovative Bulk CO₂ systems are designed to meet the high volume demands of customers. They offer the capacities and flow rates necessary to satisfy any application from small restaurants / bars to high volume stadiums, brew pubs, cineplexes, and microbreweries.

Product Advantages

- Stainless steel, double-walled, vacuum-insulated container
- Optional patented Sure-Fill™ System enables cylinder filling with no manual venting
- Stable 6" unibody legs meet health department sanitation requirements optional for all sizes
- Safe, low operating pressure
- Easy-to-read gauges for CO₂ contents and cylinder pressure
- Efficient CO₂ liquid withdrawal system
- Fully automated system requiring no electricity
- Maximizes limited space with one system replacing all of your high-pressure cylinders, using less than 3' of floor space
- Sized to match usage needs - available in a variety of sizes to meet the unique demands of your business
- NSF Certified

Product Manual

The Bulk CO₂ Storage Systems NSF Product Manual is designed to be used in conjunction with NSF certified Carbo-Max and Carbo-Mizer cylinders. If there are any questions regarding the operation of the cylinder, contact Chart's Technical Service division at 1-800-247-4446.

This manual contains information regarding the safe operation and handling of CO₂. It should be thoroughly read and understood by anyone that operates the equipment.

The schematics, piping illustrations, and parts lists located in the Specifications section show a reference number for each component used on the cylinder. The reference numbers may refer to the same functional component between the various models. The reference numbers will be used throughout this manual to draw specific attention to a component while describing its function, operation, or repair.

The safety requirements for operating the cylinder and handling or transporting extremely cold liquid products are shown in the Safety section. Use this safety section as a "Safety Checklist" each time the equipment is being used.

The Introduction section discusses the general features of the cylinder and the theory of operation.

Determining locations of the storage cylinder and the fill box are included in the Installation section. Part numbers are provided for easy identification of flush-mount and surface-mount fill boxes. This Installation section details the various connections required for the system and concludes with information on connecting to the beverage system.

The Operation and Troubleshooting section will help with instructions on filling the storage cylinder, operating the system, and general troubleshooting questions that may arise.

Terms

Throughout this manual safety precautions will be designated as follows:



Warning! *Description of a condition that can result in personal injury or death.*



Caution! *Description of a condition that can result in equipment or component damage.*



Note: *A statement that contains information that is important enough to emphasize or repeat.*

Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

ASME	American Society of Mechanical Engineers
BAR	Pressure (Metric)
CO ₂	Carbon Dioxide
DOT	Department of Transportation
DP	Differential Pressure
FDA	Food and Drug Administration
FPT	Female Pipe Thread
ID	Inner Diameter
Kg	Kilogram
MAWP	Maximum Allowable Working Pressure
MPT	Male Pipe Thread
N ₂	Nitrogen
NPT	National Pipe Thread
OD	Outer Diameter
PB	Pressure Builder
PED	Pressure Equipment Directive
PN	Part Number
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch (Gauge)

Safety

General

The system described in this manual holds and dispenses carbon dioxide (CO₂) gas under pressure. All persons using this equipment must read and understand the operation and safety information contained in this manual and must be adequately trained to operate this equipment.



Warning! *Asphyxiation hazard. Carbon dioxide gas can cause serious injury or death. Do not breathe CO₂ gas. Avoid entering cylinder area if a leak is suspected and thoroughly ventilate area.*



Warning! *Frostbite hazard. Contents are extremely cold and can cause frostbite. Do not touch liquid, ice, or ice crystals on or near cylinder. Stay away from escaping gas.*



Warning! *CO₂ vapors in air may dilute the concentration of oxygen necessary to support or sustain life. Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.*

CO₂ gas is a colorless, odorless, tasteless gas that displaces oxygen and does not support life. The gas is difficult to detect without the assistance of special equipment. Avoid breathing or contacting CO₂ in gas, liquid or solid form.

Exposure to concentrations of less than 5% can cause physical symptoms including unconsciousness, injuries or death. Even low concentrations of CO₂ can cause:

- Dizziness, headaches, nausea or disorientation
- Increased respiration or heart rate
- Shortness of breath or rapid suffocation

CO₂ is heavier than air and can collect in low areas such as basements, stairwells, and confined spaces. Avoid entry into areas where CO₂ leaks or high concentrations of CO₂ are suspected. Enter those areas with caution only after they have been thoroughly ventilated.

Whenever the cylinder is inside a building its safety relief circuit must be connected to an outdoor vent typically in the fill box. The fill box and/or vent must never be located in or above any below-ground spaces or stairwells. The cylinder must not block emergency exits, aisles, fire suppression equipment or utility boxes or accesses. CO₂ lines or hoses must be located away from traffic areas and heat sources and must be protected from potential causes of damage. All connections, lines, and components must be leak-free.

This equipment should be installed and serviced only by professional agents who are qualified to work with CO₂ and the mini-bulk liquid CO₂ storage cylinders. They should be familiar with all pertinent safety procedures.

Handle liquid so that it will not splash or spill. Protect your eyes and cover skin where the possibility of contact with liquid CO₂, cold pipes and equipment, or cold gas exists. Safety goggles or a face shield should be worn at all times when connecting to fill connections, while filling the cylinder and during disconnection from the fill connection. Clean, insulated gloves that can be easily removed and long sleeves are recommended for arm and hand protection. Cuffless trousers should be worn over the shoes to shed spilled liquid.

Equipment Safety and Handling



Note: *A bulk CO₂ storage cylinder is an ASME coded cylinder designed for permanent installation. It is not designed to meet DOT regulations and must not be transported when containing liquid CO₂. It must be shipped, stored and used in a vertical position to avoid structural damage. When loading a cylinder onto or off of a truck, use a power lift gate, crane, or an inclined ramp. Never attempt to manually lift or slide a cylinder on or off a truck bed.*



Warning! *Tampering with components may lead to serious or fatal injury. Do not plug or obstruct pressure relief devices under any circumstances. Contact certified personnel for service.*

CO₂ Monitoring Systems

The CO₂ Meter Carbon Dioxide Analyzer is a precision instrument that provides continuous, accurate monitoring of CO₂ levels to ensure a safe working environment for your employees, suppliers and yourself.

The Chart/CO₂ Meter Monitoring System is comprised of one detector (with visual and audible alarms) and one alarm repeater for remote mounting. The Chart/CO₂ Meter Monitoring System includes one detector, one alarm repeater and one relay for additional notifications.

First Aid and Emergency Action

If inhaled:

- Move to fresh air immediately
- If not breathing, give artificial respiration
- If breathing is difficult, give oxygen
- Get immediate medical attention

In case of frostbite:

- End exposure immediately
- Do not rub or pour water on the affected area
- Get immediate medical attention

Rescue:

- Do not attempt a rescue in areas of high CO₂ concentrations without proper self contained breathing apparatus.
- Thoroughly ventilate areas of possible high CO₂ concentration before entering.

In case of spills or leaks:

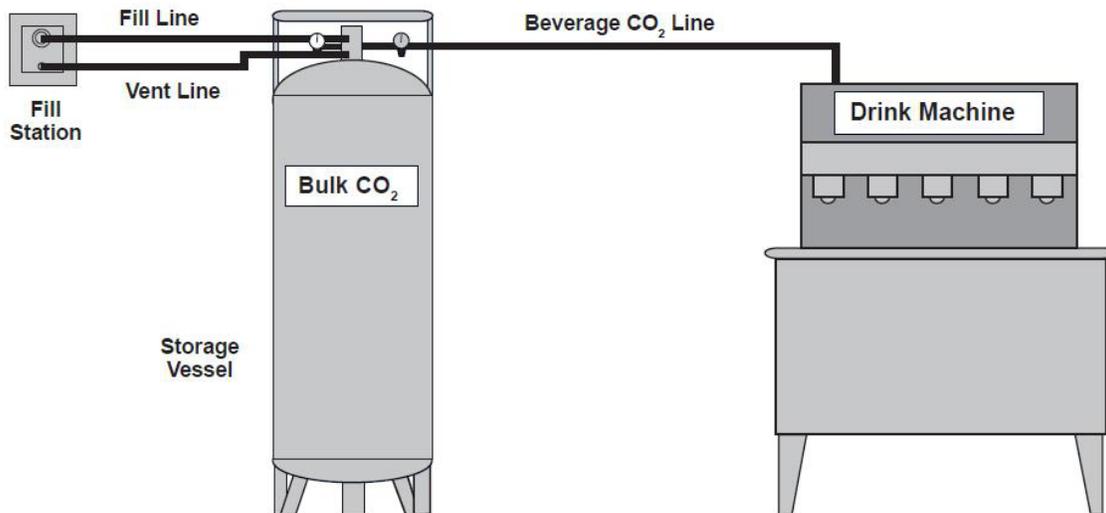
- Evacuate all personnel immediately from affected areas
- Thoroughly ventilate the area of the spill or leak before entering

Personal Protective Equipment (PPE)

The following personal protective equipment is recommended when working around cryogenic liquid:

- Safety glasses with side shields to prevent cryogenic liquid from splashing into the eyes
- Chemical / Liquid resistant gloves to prevent cryogenic burns on exposed hands
- Long sleeve shirts to protect the arms
- Cuffless trousers worn over closed shoes

Introduction



System Overview

The Bulk CO₂ Storage System is designed to provide safe, convenient low pressure liquid storage and supply of carbon dioxide gas for purposes including beverage carbonation, beer dispensing, brewing, and pH control in swimming pools. The system consists of three primary elements: the CO₂ storage cylinder, a CO₂ fill box (fill station), and connecting fill hose and vent line.

Bulk CO₂ Storage Cylinder

The storage cylinder consists of an inner cylinder and an outer cylinder, much like a giant Thermos® bottle. The space between the two cylinders contains a vacuum and additional insulating material. The vacuum and insulation minimize the entry of unwanted heat into the liquid CO₂ stored in the inner cylinder.

The cylinder construction includes an internal vaporizer (coil) and external plumbing configuration that combines to maintain adequate CO₂ gas supply rates. When CO₂ gas is needed, liquid CO₂ is drawn from the inner cylinder and converted to gas. An adjustable line regulator supplies gas to the end use point at the desired pressure. The gas use or "final line" regulator is normally set between 90 and 115 psi.

In accordance with ASME standard, primary and secondary relief valves protect the cylinder in the event of excessive pressure. Excess pressure is vented safely to the outside.

Fill Station

The stainless steel fill station (box) is the second major element of the bulk CO₂ storage system. The lockable remote fill box is permanently mounted on an outside wall. It contains a fitting for filling the storage cylinder at any time of the day without entering the store. The fill box is also equipped with a vent connection through which CO₂ gas from the storage cylinder's pressure relief or Sure-Fill™ System circuits can be released to a safe area outside. If a cylinder is located indoors and is equipped with a direct fill fitting, not using a fill box located outside, the cylinder pressure relief circuit must still be vented to the outside.

Fill Hose and Vent Line

The third major element of the stationary bulk CO₂ system is comprised of a fill hose and vent line. These two lines join the outdoor fill box with the CO₂ storage cylinder.

The fill hose, constructed with FDA approved food grade materials, is a pressure rated line that connects the brass fill fitting in the fill box with the fill circuit on the cylinder. The hose is available in standard lengths equipped with connector fittings. Common standard fill hose lengths are 5, 10, 15, 25, and 30 feet.

The vent line is as important as any component in the bulk CO₂ system. It connects the safety relief valves and the Sure-Fill system on the cylinder to either the outdoor fill box vent fixture or to an alternative outdoor vent tube.

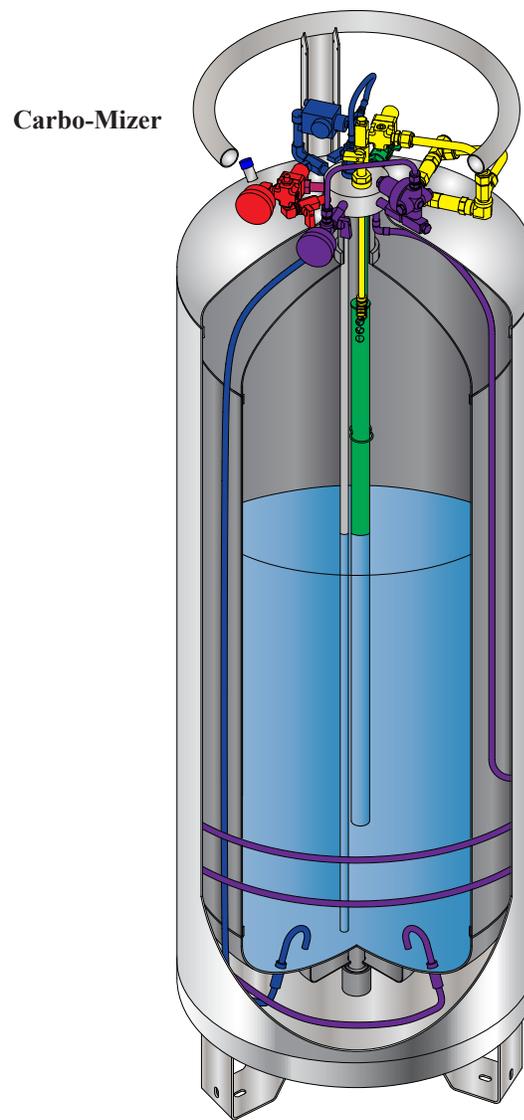
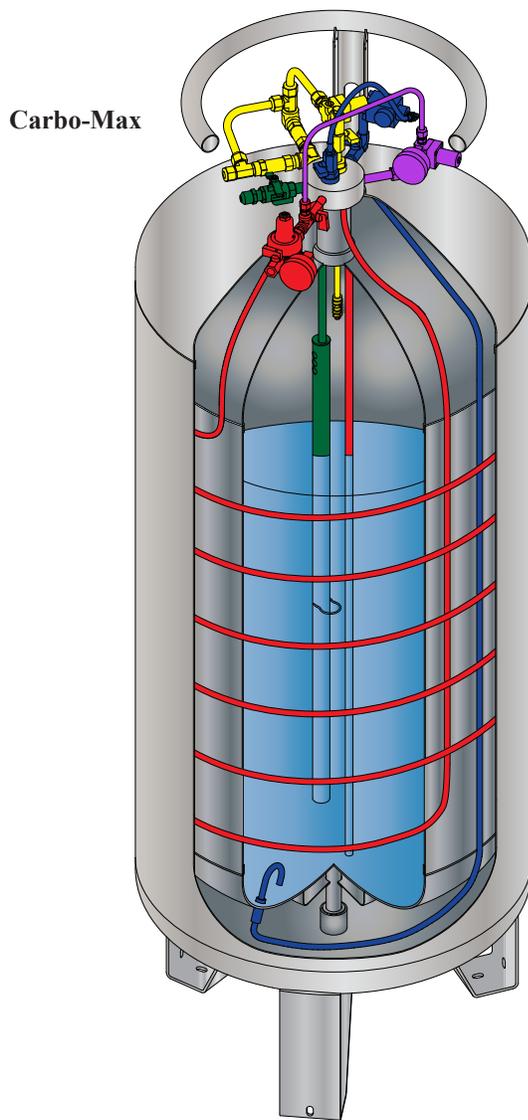


Note: When used indoors a CO₂ storage cylinder must always be connected with a vent line to the outdoors (see Safety section).

Cylinder Plumbing

Plumbing components on the liquid CO₂ storage cylinder perform five functions (refer to illustrations on this page):

1. The fill tube allows liquid CO₂ to be transferred into the cylinder during the delivery process. (shown in green)
2. The gas-use circuit dispenses CO₂ gas to the end use system (shown in red).
3. The pressure control circuit (Economizer on Carbo-Max HF cylinders, PB on Carbo-Mizer cylinders) maintains optimal operating pressure and conserves gas for efficient system performance (shown in purple).
4. The relief/vent circuit allows excess pressure to safely exit the cylinder and the building (shown in yellow).
5. Contents (shown in blue) and pressure gauges monitor the status of the CO₂ inside the storage cylinder.



Installation

Equipment Location

Site Survey

Prior to installation of the CO₂ system components, a site survey should be performed to determine the best location for placing the bulk CO₂ cylinder and the fill station. As a matter of safety, this would be a good time to determine the proper location for a CO₂ monitor (CO₂ is 1-1/2 times heavier than air and in the event of a leak is likely to collect in low-lying and confined spaces). Bulk CO₂ cylinders should be installed outdoors in an unenclosed space whenever possible. Cylinders should not be installed on roofs, in basements, or below grade. Cylinders should have foundations or floors capable of supporting the full weight of the cylinder plus product. Cylinders should not be installed near electrical panels, ventilation intakes, stairwells or elevators.

A site survey form created by the installer should be used to plan, understand, and approve the best location for the equipment. The survey must be conducted with the store owner or their designated representative and the system installer. Any subsequent modifications to the installation should be noted on the form and signed by the store representative and the installer.

Fill Box Location

The fill box location must be determined before locating the CO₂ cylinder. A fill box is typically mounted on a back wall at a height of 3-1/2 to 4 feet. It should be located out of the way of store customer operations if possible. It must be located within a distance allowing easy delivery access and considering the length of the fill hose from the delivery truck.

While determining the best location for the fill box always check the inside wall of the proposed location to be sure the box installation will not interfere with appliances in the store and will not damage anything inside the wall such as plumbing and electrical conduits. In some stores the fill line between the fill box and the storage cylinder must be sleeved. In those cases be sure to locate the box where it will allow the inside sleeve to have adequate radius for the fill hose to easily pass thru for installation and for future maintenance. The sleeve must not interfere with store operations.

The fill box and/or vent must never be located in or above any below-ground spaces or stairwells. The cylinder must not block emergency exits, aisles, fire suppression equipment or utility boxes or accesses. CO₂ lines or hoses must be located away from traffic areas and heat sources and must be protected from potential causes of damage. All connections, lines, and components must be leak-free.



Warning! *Pressure relief valves and associated remote vent lines should be located to minimize tampering, damage and obstruction to flow. The inlet of the pressure relief valves shall not be blocked by a valve, plug or other obstructions. The outlet of the remote vent line shall not be blocked and should be protected from obstructions such as ice, insect nests, dirt, etc.*

Storage Cylinder Location

Once the fill box location has been defined, the location of the CO₂ storage cylinder can be determined. The primary considerations for placing the storage cylinder are space and distance from the fill box. The storage cylinder must be placed as close to the fill box as possible to maximize filling efficiency; ideally within 25 feet. The distance from the storage cylinder to the beverage machine or other use point is not critical.

The storage cylinder should not be installed in hallways. It should be placed in locations out of the way of other fixtures such as electrical panels and sinks. Although the cylinder should be in the most out-of-the-way location available, it must be placed where it is accessible for service and in a manner that allows its gauges to be read. Cylinders installed outside near traffic should have protective bollards or guards installed. Check local codes for specific requirements.



Note: *To prevent damage to the cylinder's plumbing components the cylinder's handling ring must never be used as a hanging rack or platform for storage.*

Installation Equipment

Installation Tools and Supplies

Installation of the bulk CO₂ system requires certain tools and installation materials. A supply of the following materials and tools should be maintained for most simple and economic installations though not all installations will require them:



Warning! *When using the following tools, suitable eye and ear protection must be worn. Failure to do so could result in serious personal injury.*

Tools

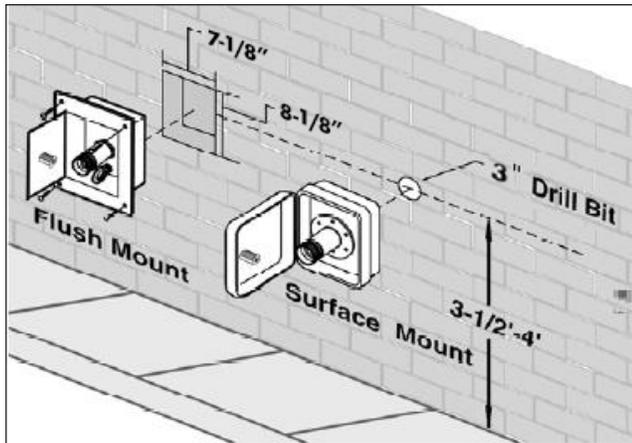
- Electric Hammer Drill - for drilling holes and chiseling brick. Accessories:
 - 3/4" x 21" Scaling Chisel
 - 3" Core Bit
 - 1" x 21" Masonry Bit
 - 1/4" x 13" Masonry Bit
 - 1/2" Masonry Bit
 - 7-1/4" Builder's Circular Saw - for scoring brick and cutting wood exteriors. Accessories:
 - Masonry Cut-Off Wheel
 - Combination Blade
 - Reciprocating Saw - for cutting through wood walls. Accessories:
 - Metal Cutting Blades
 - Wood Cutting Blades
 - Electric Hand Drill - for drilling anchor holes. Accessories:
 - 1/4" and 3/8" Masonry Bits
 - Set of Twist Drills
 - 3" Hole Saw
 - Oxyacetylene Torch - for cutting rebar in poured concrete walls and floors.
- ### Supplies
- Hand Truck with Strapping Attachment
 - Torpedo Level
 - Carpenter Square
 - Extension Cord
 - Oetiker Clamp Pliers
 - Step Ladder
 - Caulk Gun
 - Assorted Hand Tools
 - Flashlight
 - Silicone Sealant (clear and white)
 - 2" PVC Pipe and Elbows
 - 1/4" Plastic Screw Anchors
 - 1/4" x 1" Self-Tapping Screws
 - 9" Cable Ties
 - PVC Cement
 - Duct Tape
 - Teflon Tape
 - PVC Flanges
 - Chalk or Other Marker
 - Leak Check Solution

Fill Station (Wall Box) Installation



Note: For fill-box diagrams and components identification refer to the Specifications section of this manual

If possible, select a fill station location that will not interfere with store / customer operations. A neat and clean installation is important since the fill station is visible to the general public.



Before marking the fill station location on the exterior wall, check to be sure the fill box will not interfere with any electrical, plumbing, or gas lines inside or outside the store.

Flush-Mount Fill Box (PN 21430874 & 21430876)

- Using a pre-cut template or carpenter's square and a level, mark a rectangle with dimensions 7-1/8" W x 8-1/8" H on the exterior wall making sure the marking is plumb. Match the fill box to the outline on the wall to make sure the outline is correct.
- Using a circular saw, make a 1/2" to 1" perimeter cut along the inside of the outline. Use a masonry blade to cut brick, concrete or block wall.



Caution! Do not attempt to remove material from the wall without first making the perimeter cut.



Warning! To help prevent serious injury, always wear goggles, gloves, and a dust mask when making perimeter cuts.

- Use a hammer drill and 3/4" scaling chisel to remove brick or concrete material within the perimeter of the

cut. Begin chiseling near the bottom of the perimeter and work toward the top.

For easier separation of wall material from a poured concrete wall, drill 3/4" holes about 3" deep around the inside of the perimeter to perforate the material before chiseling.



Warning! Be very careful when handling the chisel. The chisel may have a tendency to "jump" and could cause personal injury or damage to the surrounding wall.

- Remove debris from the hole.



Note: Some concrete walls contain reinforcing rods. Cut rebar with an oxyacetylene torch if necessary.

- Slide the box into the opening and make sure its flange lies flat against the wall surface.
- While holding the box in position mark the four corner mounting holes.
- Drill the corner mounting holes about 1-1/2" deep using a 1/4" drill bit or masonry bit as necessary. Insert plastic screw anchors.
- Drill a 3" 'center hole' in the back of the fill box opening using a 3" core bit.



Caution! To prevent damage to the inside wall surface, the center hole may need to be drilled from inside to outside. To accomplish this, first drill a 1/4" pilot hole through from the outside; then drill the 3" hole from the inside using the pilot hole as a guide.

- Insert the box into position and fasten it using sheet metal screws.

Surface-Mount Fill Box (PN 21430873 & 21430875)

When the use of a surface mounted box is preferred, it will simply be mounted onto the outside surface of the store wall.

- At the desired fill box location mark and drill the center hole using a 3" bit.

- Place the box in position so its fill and vent fittings are within the 3" hole. Mark the four corner holes while using a carpenter's level to make sure the box is level.
- Drill the four corner pilot holes. Use a 1/4" bit if necessary for screw anchors. Insert the anchors.
- Fasten the box in place using sheet metal screws.



Note: In the event that a fill hose needs to be attached at a right angle to the fill box, a flare fitting 90° elbow (Chart PN 11388573) may be used to connect the fill hose to the fill fitting.

Fill Hose Line Installation

Fill and vent lines will likely be routed differently in each store. By following basic recommendations, the lines should be run properly and as easily and simply as possible.

Distance from the outside fill box to the CO₂ storage cylinder should be as short as possible and typically varies from 1 to 30 running feet. Fill line distances of longer than 30 feet are not recommended because longer fill hose length results in reduced CO₂ fill efficiency.



Note: When installing the fill and vent lines please be aware that they need to be accessible for inspection and service. The lines should be inspected at least once a year for leaks, damage, or signs of wear. They should be replaced every eight years.

Fill and vent lines are generally secured together with cable ties about every 18 inches and attached to the wall using conduit straps about every 2 or 3 feet along the run. The lines should run either horizontally or vertically and as inconspicuously as possible. Excess line should be coiled and tied.

Running lines through a conduit sleeve is generally not necessary. However, if the lines were to be exposed in a high traffic area, it may be best to run them through a sleeve to ensure protection. Sleeve material generally used is 2" or 3" PVC piping.

Connect Lines to Fill Box

- Gain access to the back of the fill box by temporarily removing the box from its mount.



Note: The fill fitting is fastened to the fill box by four lock nuts on threaded studs. The fitting can be easily removed for service or for attaching the fill line.

- Fasten the vent line simply by pushing the line onto the barbed fitting on the back of the fill box.
- Fasten the flare connector on the end of the fill hose to the flare connection end of the fill fitting.

Run Lines to Cylinder Location

- Feed the fill and vent lines through the wall (or PVC wall flange if used) to the inside of the store.
- Re-attach the fill box if necessary.
- If sleeve material is not being used, route lines to the cylinder location according to plan and attach them to the wall with conduit straps about every 2 or 3 feet. Proceed to CO₂ storage cylinder installation.
- If a sleeve is being used, size and cut the sleeve material to the proper length and with a bend radius toward the wall flange. Bond sleeves to elbows with PVC glue only if necessary. If the connections are not bonded they will be easier to separate when future service is required. If the connections are bonded the bend radius should allow the fill hose to slide freely within the sleeve for future maintenance and replacement.



Note: A fill hose should be replaced every eight years.

- Feed the fill and vent lines through the PVC sleeve conduit and run the sleeve conduit to the CO₂ storage cylinder.
- Attach the PVC sleeve to the wall with conduit straps. Proceed to CO₂ storage cylinder installation.

CO₂ Storage Cylinder Installation

The bulk CO₂ storage cylinder should be installed in compliance with local code requirements as applicable. It should be installed in an area having free flowing air space and out of the way of pedestrian traffic. It should be located away from chemical storage areas. The cylinder should be positioned so its plumbing components are accessible for service and so its gauges are facing "forward" and are readable.



Caution! The storage cylinder must be vented to the outside to prevent hazardous CO₂ concentrations from developing if a pressure relief valve should open.

Bolting a Cylinder (with 6" legs) to the Floor

1. Place the cylinder in its best position and mark three floor-anchor holes through the holes in the bottom of the legs. Move the cylinder.
2. Drill holes with a masonry bit having the same diameter as the anchor. Make sure the hole depth exceeds the minimum embedment of the anchor.
3. Assemble each anchor with a nut and washer so the top of the nut is flush with the bolt. Drive each anchor into a floor hole until the nut is against the surface of the floor. Expand the anchor by tightening the nuts 3-5 turns until firmly tight. Remove and save the nuts and washers.
4. Move the cylinder back into position being careful that the hold in the bottom of each leg is over an anchor bolt. Place a washer and nut onto each bolt and tighten.

Connect Line to the CO₂ Storage Cylinder

Bulk CO₂ storage cylinders contain positive CO₂ gas pressure when they are shipped. Before installing the lines onto the cylinder, any residual pressure should be vented off by simply opening the gas-use valve.

1. Connect the liquid fill hose to the inlet flare fitting on the cylinder, then open the cylinder valve.
2. Squarely cut the vent tubing to the proper length and attach the tubing to vent the circuit fitting of the cylinder.
3. Connect the supply line tubing to the cylinder's supply regulator.



Note: Do not use copper tubing for CO₂ gas supply.

For best results, the cylinder should be filled at this time to ensure that the lines are properly purged before use with the beverage system. This is also the best time to check the system for leaks.

Connecting to the Beverage System

The gas-use line from the CO₂ storage cylinder to the beverage equipment or other end use point(s) will probably be run differently in each location. The distance from the CO₂ cylinder to the equipment is not critical and can be several hundred feet.

Beverage tubing lines with 1/4" ID are generally adequate for service up to 50 feet. For longer runs a larger ID tubing may be desired to compensate for pressure drop. See the chart on the next page for recommended gas line sizes for various distances. For certain applications where several 'stations' are supplied by a single CO₂ source, a larger diameter 'header' or 'trunk' line may be used while teeing 1/4" 'drop' lines to supply individual stations. By following basic recommendations described in this section, CO₂ supply lines can be run as easily and as effectively as possible.

1. Run the gas use line in a manner that is as inconspicuous as possible.
2. The line should be attached along the run in horizontal or vertical orientation; level and plumb wherever possible to present a neat and careful installation. Never leave loose line hanging.
3. Cut the line to proper length.
4. Secure connections to the CO₂ storage cylinder's final line (supply) regulator and to the drink system equipment using appropriate fittings.
5. Open the gas-use isolation valve on the bulk CO₂ storage cylinder and check the supply regulator gauge for proper set pressure within the range of 90-115 psi while gas is flowing.
6. Perform a leak check with soap solution on all joints to the drink system and correct as necessary.



Note: Beverage systems consist of a variety of equipment functions. Each function may require a different CO₂ pressure. The bulk CO₂ storage system supplies a pre-set CO₂ pressure of about 110 psi. Therefore, secondary or 'step-down' regulators should be used as necessary to meet the requirements of system functions. Since high pressure regulators normally used on high pressure cylinders are constructed to respond to very high inlet pressures, they may not perform properly in the low pressure bulk CO₂ system and their use is not recommended.

Gas-Use Tubing Size / Distance Recommendations From a Single Supply Regulator				
Tubing ID	To 1 Carbonator	To 2 Carbonators	To 3-5 Carbonators	To 6-8 Carbonators
1/4"	0' - 50'	0' - 20'	--	--
3/8"	51' - 250'	21' - 100'	0' - 20'	--
1/2"	251' - 500'	101' - 500'	21' - 100'	0' - 50'
5/8" * or (2) 1/2"	--	--	101' - 250'	51' - 100'
3/4" * or (3) 1/2"	--	--	251' - 500'	101' - 250'

*Non-standard tubing

Operation and Troubleshooting

Filling the CO₂ Storage Cylinder

First Fill

The first fill of the cylinder cools the inner cylinder of the storage system. Since the inner cylinder of a new CO₂ storage cylinder is relatively 'warm,' its first fill may take 20 to 30 minutes and a larger than normal amount of CO₂ gas will be vented during the fill. A higher-than-normal operating pressure can be expected for several days after the first fill.

1. Open the fill box door and inspect the threaded fill-fitting for debris and damage. Wipe the fitting with a clean dry cloth if necessary.
2. Inspect the delivery hose quick-connect and wipe the fitting if necessary.
3. Connect the delivery hose to the fill box fill fitting. If filling a cylinder equipped with the Sure-Fill[®] System option proceed to step 7.
4. Open the liquid delivery valve to allow liquid CO₂ to flow into the cylinder. CO₂ will stop flowing when the cylinder's pressure equals the pressure of the delivery source. At this point the cylinder should be just over half full.
5. Close the liquid delivery valve; then open the vent valve on the delivery hose assembly to reduce pressure in the cylinder. Drop the cylinder pressure to 125 psi. Close the vent valve.
6. Repeat the liquid delivery and vent cycle as often as necessary to fill the cylinder.



Note: *The initial fill will take considerably longer time than subsequent fills. If scheduling permits, it can be a good idea to initially fill the cylinder about halfway and then return in a day or two to complete the fill.*

7. When filling a cylinder equipped with the Sure-Fill vent option, make sure the isolation valve in the Sure-Fill relief circuit is open.
8. Open the liquid delivery valve to allow liquid CO₂ to flow into the cylinder. The Sure-Fill vent valve will open

when the cylinder pressure reaches approximately 200 psi. At that point a pressure relief venting noise will be heard from the vent fitting below the fill connection in the fill box. Continue filling.

9. When the venting stops the cylinder is full. Disconnect the fill hose from the fill station.
10. Using a leak check solution check all connections and fittings on the cylinder and fill box for leaks. Tighten connections if necessary.

General CO₂ Delivery

To minimize delivery expense, delivery frequency should be scheduled to allow a 200-500 pound delivery; depending on cylinder size. For most restaurants, this will be every 20-30 days. Delivery routes are typically planned to minimize travel time and "rush-hour" traffic situations.

1. Delivery vehicle pressure must be maintained at 280-300 psi for proper operation. Low delivery pressure can cause 45-50 minute fill times.
2. A delivery pressure of at least 50 psi higher than the restaurant storage cylinder pressure should be maintained during filling. A low pressure differential will cause long fill times.
3. Maintain a delivery log for each account to help detect irregularities in CO₂ consumption.
4. Adjust delivery program to longer intervals between deliveries as consumption justifies.

Carbon Dioxide Consumption

The amount of CO₂ that will be consumed in the variety of restaurant applications is almost impossible to predict. While primarily used for beverage carbonation, CO₂ is also used for carbonating frozen drinks and for driving pumps and automatic dispense systems.

A typical 16 oz. soft drink contains about 2.4 oz. of syrup and water carbonated with 0.0112 lb. of CO₂ (approximately 1 lb. of CO₂ is required to carbonate one hundred 16 oz. drinks). The table below shows an estimate of CO₂ consumption just for beverage carbonation based on a use ratio of 0.6 lb. CO₂ per gallon of syrup.

Weekly Syrup Usage (gallons)	Bag-In-Box Containers	CO ₂ Consumption for Carbonation (lb.)
10	2	6
20	4	12
30	6	18
40	8	24
50	10	30
60	12	36
70	14	42
80	16	48
90	18	54
100	20	60

CO₂ is also used to 'push' beer from kegs. To push a 'direct draw' beer dispense system, which dispenses directly from the keg, only the fresh-keg (rack) pressure of 12 to 15 psi needs to be maintained on the keg to pour the beer and prevent excessive foaming caused by over-carbonation.



Note: To push beer greater distances in common 'long draw' dispense systems higher gas pressures are required. However, to avoid over-carbonation and excessive foaming, that higher gas pressure must consist of a calculated blend of CO₂ and N₂. Blend gas equipment is available for this purpose.

The following table shows the approximate amount of CO₂ consumed to dispense beer.

15.5 Gallon Kegs	CO ₂ Consumption (lb.)
10	2.5
20	5.0
30	7.5
40	10.0
50	12.5
60	15.0

Operating the Bulk CO₂ System

The store operator should be familiar with basic elements of the system. The installer is responsible for explaining the CO₂ system to the store operator upon completion of the bulk CO₂ system installation. The following table describes functional elements of the system and is intended to assist with that explanation.

Component	Function
CO ₂ Contents Gauge	Indicates the approximate amount of liquid CO ₂ inside the cylinder.
CO ₂ Cylinder Pressure Gauge	Indicates cylinder pressure. Normal operation pressure is between 110 and 175 psi. Cylinder pressure may be as high as 300 psi after a CO ₂ delivery
Final Line (Supply) Regulator Note: Actual regulator may not match style shown in diagrams in this manual.	Controls pressure in supply line from cylinder to beverage equipment.
Final Line (Supply) Regulator Gauge	Indicates supply pressure in the gas-use line. Final line (gas-use) pressure is normally 90 - 115 psi.
Gas-Use Valve	On / Off valve for gas supply.
Primary Relief Valve	Prevents cylinder pressure from exceeding 300 psi.
Vent Hose	Vents excess gas pressure to fill box outside.
Fill Hose	Transports liquid CO ₂ from fill box to cylinder during fill.
Fill Box	Connection point for liquid CO ₂ delivery and transfer line.
Filling Schedule	Should be established with supplier based on CO ₂ use (normally every 4-6 weeks).
Periodic Frost	Frost indicates that liquid CO ₂ is being converted to gas to meet a demand. Frost near the bottom of the cylinder is normal during periods of high or continuous use.
Continuous Frost	Continuous presence of frost during non-business hours or in mornings before business hours indicates a demand for CO ₂ gas perhaps caused by a leak in the beverage system.

Facts to Know

1. A cylinder's normal internal operating pressure is between 125 psi and 150 psi, which is sufficient pressure to supply the carbonator (typically 90 psi) and low enough pressure to be filled directly.
2. Cylinder pressure can be as high as 300 psi after a delivery but returns to its normal operating pressure after a day or two of normal CO₂ use.



Note: *Topping off small amounts of liquid between normal delivery cycles will add excessive heat to the cylinder keeping the pressure high.*

3. The gas supply pressure is normally between 90 psi and 120 psi.
4. Frost or condensation on the cylinder is normal during periods of CO₂ use.
5. Frost or condensation on the cylinder before starting the daily use of CO₂ is a sign of a CO₂ leak. Have the leak fixed.
6. CO₂ weight will vary depending on the saturation pressure. The vessel's name corresponds to the full weight of CO₂ in pounds. For example, a Carbo-Max 750 holds approximately 750 lbs of CO₂.



Note: *Use rates vary based on cylinder size and type. Typical use rates for Mizer style cylinders are between 30 to 150 lbs per week. Typical use rates for Carbo-Max style cylinders are between 50 to 300 lbs per week.*

7. The contents gauge displays the approximate amount of liquid CO₂ in the cylinder.
8. CO₂ becomes dry ice below a pressure of 61 psi. Stop using CO₂ from the cylinder if its pressure reaches 70 psi or less.
9. An isolation (shut-off) valve is open when its handle is parallel to the valve body and the line. The valve is closed when its handle is perpendicular to the valve body and the line.

General Operation Notes

1. Always use caution when working with CO₂. Read and understand the Safety Section of this manual.
2. The Beverage system does not require adjustment under normal operating conditions.
3. In an emergency the flow of CO₂ from or through the storage cylinder can be stopped by closing the red-handles valves marked with the Emergency Shut-Off labels.
4. For CO₂ equipment issues, call your CO₂ supplier or service specialist. Before calling for service or troubleshooting assistance, please have the following information at hand:
 - Serial number of the cylinder
 - Description of the problem
 - Readings from:
 - the cylinder contents gauge,
 - the cylinder pressure gauge, and
 - the final line pressure gauge
 - Observations such as unusual frosting and/or events related to the problem
5. Every day before starting operations and CO₂ use check for:
 - CO₂ leaks (see Safety)
 - Pressure readings
 - CO₂ contents
 - Abnormal frost or condensation
 - Anything unusual

Troubleshooting

The following table is arranged in a Trouble/Probable Cause/Remedy format. The probable causes for specific problems are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next. Perform all procedures in the order listed and exactly as stated (Refer to diagrams in the Specifications section as required to locate system components identified in the troubleshooting guide.) If you need further assistance please contact Chart's service team at 1-800-253-1769.

Trouble	Probable Cause	Remedy
No CO ₂ to carbonator or use-point system. OR Carbonated drinks are flat.	CO ₂ storage cylinder is empty.	Switch to emergency CO ₂ gas cylinder. Call CO ₂ supplier for delivery
	Isolation valve to final line regulator is closed.	Open valve or valves as required.
	Cylinder pressure is low (110 psi or less).	Switch to emergency CO ₂ gas cylinder. Stop CO ₂ withdrawal from bulk CO ₂ cylinder by closing isolation valve. If cylinder pressure fails to rebuild see section on low cylinder pressure.
	Pressure building regulator is not operating properly; is set too low, plugged, or faulty (closed).	Ensure that isolation valves are open (valve handles should be parallel with the line). Call CO ₂ service agent.
	Pressure relief "Economizer" regulator not operating properly; set too low or stuck open.	Close supply pressure valve and switch to emergency CO ₂ gas cylinder. If cylinder pressure fails to rise within 24 hours see section below on low cylinder pressure.
	Unknown	Call CO ₂ service agent.
Frost on the bottom, sides, or top of the cylinder.	A normal condition during or following CO ₂ use.	None
	Leak in beverage system and/or gas supply lines or CO ₂ fill box.	See Safety section. Evacuate and ventilate. Check for frost in the morning before CO ₂ has been used. If possible, locate and correct leak. Call appropriate equipment service agent.
Frost on cylinder after extended periods of no CO ₂ use; such as in the morning before store operations begin.	Leak from the beverage system, CO ₂ cylinder's plumbing, or fill box. Bag-in-box pump running because B.I.B. is empty.	See Safety section. Evacuate and ventilate the room. Locate and correct leak if possible. Call appropriate service agent.
Constant low cylinder pressure (Gauge below 125 psi for Carbo-Mizer or 150 psi for Carbo-Max).	PB regulator set low or plugged.	Call CO ₂ service agent for service.
	PB shut-off valve closed.	Open valve by turning handle parallel to line.
	Economizer regulator set too low or stuck open.	Call CO ₂ service agent.
	CO ₂ leak from cylinder plumbing, CO ₂ fill box and/or cylinder safety system.	See Safety section. Evacuate and ventilate the room. Call CO ₂ service agent.

Trouble	Probable Cause	Remedy
Constant high cylinder pressure (above 200 psi).	Normal condition for several hours following a CO ₂ delivery	None
	Normal when little or no CO ₂ is used.	None
	PB regulator set too high or stuck open.	Call CO ₂ service agent.
	Economizer regulator set too high or stuck closed.	Call CO ₂ service agent.
	Cylinder has a weak vacuum insulation.	Call CO ₂ service agent.
	Repetitive small deliveries	Refill cylinder when less than half full.
High CO ₂ consumption.	Increased beverage sales or CO ₂ use.	None
	Cylinder pressure constantly high.	See section on cylinder pressure too high.
	CO ₂ leak from cylinder plumbing, CO ₂ fill box, gas lines, and/or beverage or other use-point equipment.	See Safety section. Evacuate and ventilate the room. Locate and correct leak if possible. Call appropriate service agent.
	Error in CO ₂ supplier invoice.	Check CO ₂ usage history / pattern against supplier invoices. Consult CO ₂ supplier.
CO ₂ cylinder will not fill.	CO ₂ cylinder is already full.	None
	Fill valve is shut off or is faulty.	Consult CO ₂ service agent.
	Brass fill fitting in CO ₂ fill box and/or on truck's delivery hose is faulty.	Consult with CO ₂ supplier or service agent. Have brass fill fitting(s) replaced if necessary.
	Pressure difference between store cylinder pressure and delivery pressure is too small.	Verify delivery cylinder pressure is at least 275 psi and store cylinder pressure is between 110 and 150 psi. Vent store cylinder to lower pressure if needed (never vent store cylinder pressure to lower than 125 psi).
	Sure-Fill™ System assembly does not vent gas because the Sure-Fill valve is closed or cylinder pressure did not return to normal operating pressure (after previous fill).	Cylinder pressure must drop below 200 psi between filling times to allow the 'check' ball to fall into the open position. Check that the Sure-Fill valve is open. Consult CO ₂ service agent.
	Leak in Sure-Fill regulator (pressure above Sure-Fill check ball is lower than cylinder pressure).	Close valve at Sure-Fill regulator for several minutes to allow pressure above check ball to equalize and ball to fall into the open position. Contact CO ₂ supplier.
	Delivery cylinder empty or truck delivery hose is obstructed, e.g. vehicle stopped on hose or hose is bent.	Ask driver to make another delivery or clear obstruction or wait until obstruction clears.
Hissing sounds or evidence of gas leak.	Normal for short periods of time from some regulators and relief valves. Observe leak. If it is not large and does not last long and does not occur frequently, no action is needed.	

Trouble	Probable Cause	Remedy
Hissing sounds or evidence of gas leak (continued).	Large leaks from elsewhere in the system, sustained leaks, or frequent leaks, are not normal.	See Safety section. Evacuate all personnel from affected areas. Ventilate the area. Call CO ₂ service agent.
Final line / gas-use pressure gauge indicates less than 90 psi.	Final line regulator intentionally set lower by beverage service agent.	None
	Final line regulator not operating in proper pressure range.	Call CO ₂ service agent.
	Final line pressure gauge damaged or faulty.	Call CO ₂ service agent.
	One or more of the causes listed in "no CO ₂ " or "flat drinks" problem section.	See indication sections regarding "no CO ₂ " and "flat drinks" etc. Call CO ₂ service agent.

Fill Box Troubleshooting

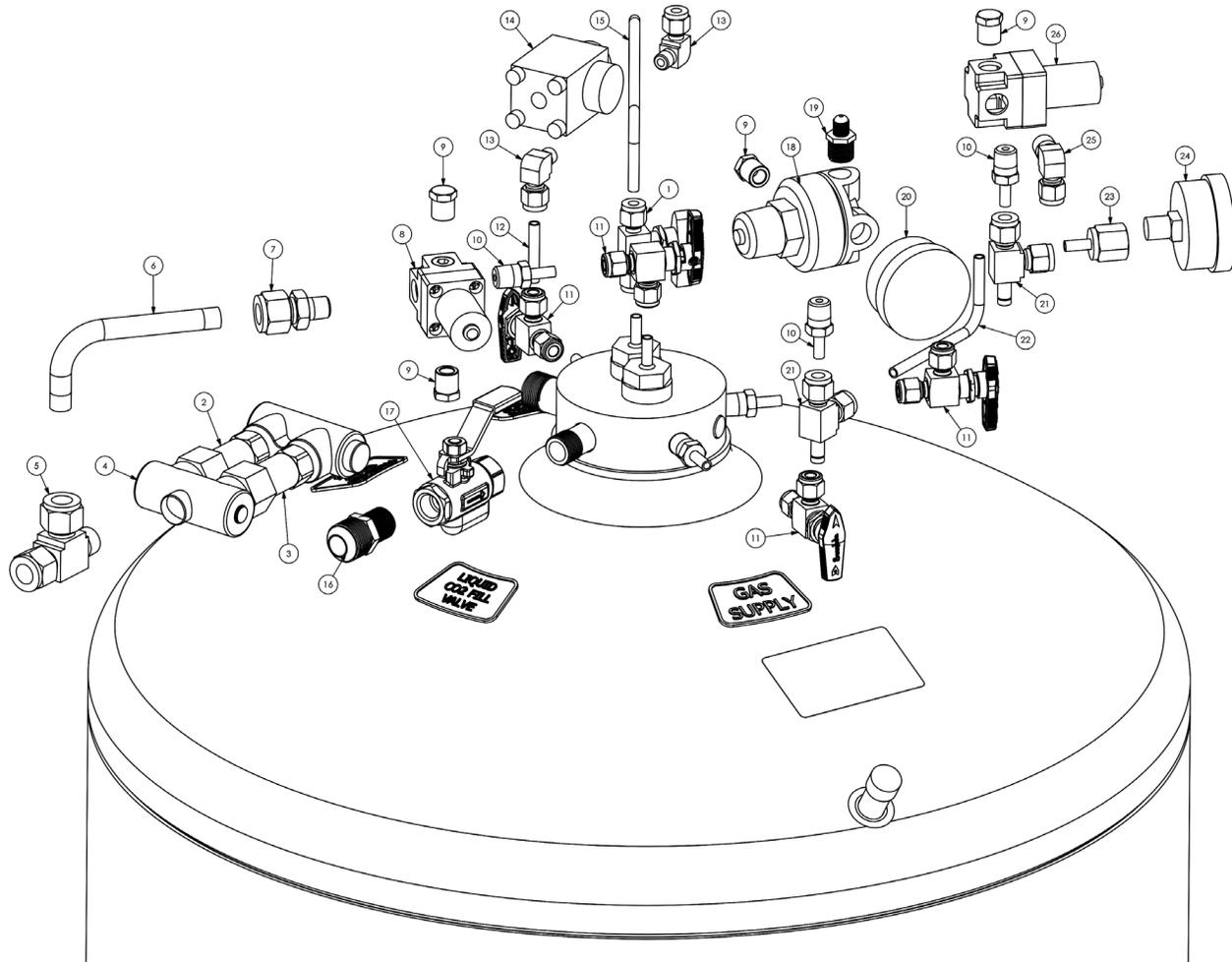
Trouble	Probable Cause	Remedy
Fill box door will not close, lock, or open.	Wrong key.	Verify correct key and retry. Contact CO ₂ supplier for spare key. Order new key.
	Lock dirty or damaged	Clean and oil lock Replace lock if necessary
Brass fill fitting in fill box leaking or hissing.	Particle of ice or debris caught in fill fitting poppet.	If driver is still on-site, reconnect CO ₂ delivery hose and then disconnect. If driver is not available, carefully press poppet with dull instrument to re-seat poppet. If leak continues after line warms, close the fill isolation valve and call service agent.
	Fitting is defective or sealing surface is worn due to normal wear.	Close the fill isolation valve on the cylinder and call service agent to replace fitting.
Threads on brass fill fitting are worn or stripped.	Normal wear. Fill fitting must be replaced	Contact CO ₂ service agent to replace fitting.
	Fill fitting cross threaded with the CO ₂ delivery hose coupler.	Contact CO ₂ service agent to replace fitting.
CO ₂ is venting from fill box	Normal during CO ₂ delivery.	None
	Normal for short periods of time if cylinder is at or over 300 psi. (200 psi for cylinders equipped with surefill)	None if for short period(s) of time. If cylinder pressure is consistently over 200 psi, see section on "cylinder pressure too high."
	Fill fitting is not sealing properly.	Call CO ₂ service agent to replace fitting.

Carbo-Max® Specifications

	Carbo-Max 600	Carbo-Max 750
Diameter (in/cm)	22 / 55.8	26 / 66.0
Height (in/cm) (with legs)	75.938 / 192.9 (without legs subtract 6")	73.875 / 187.6 (without legs subtract 6")
Empty Weight (lb/kg)	323 / 146	430 / 195
Full Weight (lb/kg)	926 / 420	1221 / 554
Net Storage Volume (gal/ltr)	64 / 244	85 / 320
CO ₂ Storage Capacity at 125 psig	603 / 274	791 / 359
Gas Use Connection	1/4" 45° Flare	
Fill Line Connection	5/8" Male 45° Flare	
Vent Line Connection	1/2" OD Tubing	
Rates and Pressures		
CO ₂ Gas Delivery (continuous) (12 consecutive hrs @ room temp)	15 lb/hr (6.8 kg/hr)	
Peak CO ₂ Gas Flow Rate (4 consecutive hrs & room temp)	40.0 lb/hr (18.1 kg/hr)	
Evaporation Rate (No loss in normal use)	3.0 lb/day (1.4 kg/day)	
MAWP	300 psig / 20.7 barg	
ASME Relief Setting	300 psig / 20.7 barg	
Additional Relief Setting	450 psig / 31.0 barg	
Sure-Fill™ CO ₂ Cylinder Filling System Relief Setting	200 psig / 13.8 barg	
Design Criteria		
Design Specifications	ASME Section VIII, Division 1 / Meets with US and Canadian approvals / Approved for EU	
Fill System	Single line, pressure differential	
Sure-Fill System	Standard	
Insulation Type	Vacuum with Super Insulation	
Pressure Control	Pressure Relief (Economizer) circuit	
Liquid Level Gauge	Differential Pressure Standard	
Outer Cylinder Material	Stainless Steel	
Inner Cylinder Material	Stainless Steel	
Floor Mount Design (Meets NSF Standards)	Permanent Legs	

Carbo-Max 600 & 750 Part Identification

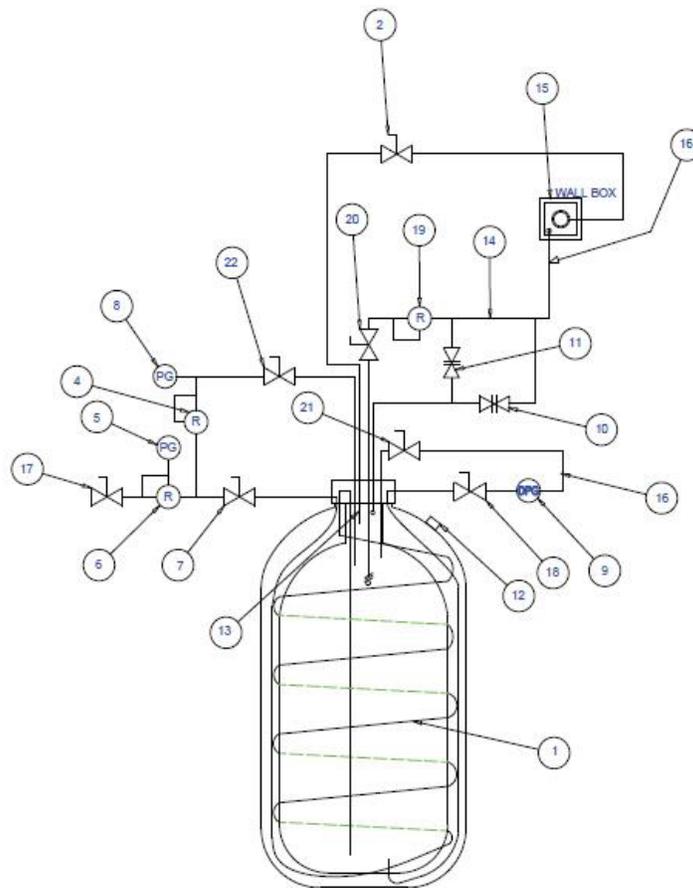
Equipped with Sure-Fill™ CO₂ Cylinder Filling System and DP style contents gauge.



Item	PN	Description
1	21367290	VALVE ISO PLATED BRS 1/4 OD ST
2	11547714	RV BRS 1/4MPT 300 PSI ASME
3	1812062	RV BRS 1/4MPT 450 PSI
4	21303884	REGO RV MANIFOLD
5	13832906	TEE BRS M RUN 1/2 ODT x 3/8MPT
6	14275419	TUBE SUREFILL VENT
7	13832914	CONN BRS 1/2 ODT x 1/4MPT
8	13154834	REGULATOR SUREFILL 200 PSI
9	21367292	PLUG HEX 1/4MPT
10	21367286	TUBE ADAPTER 1/4 OD X 1/4MPT
11	21367288	VALVE ISO PLATED 1/4 OD
12	21495733	DP GAUGE TUBE STRAIGHT
13	13760615	ELBOW SS 90D 1/4OD x 1/8MPT
14	21094533	DIFF PG 0-53"
15	21495734	DP GAUGE TOP TUBE
16	21367293	CONN SS 5/8OD x 3/8MPT 450 PSI
17	20953805	VALVE BALL 3/8NPT

Item	PN	Description
18	21178190	REGULATOR 1/4MPT @ 115 PSI
19	21368770	GAS USE CHECK VALVE
20	13321006	PG DIAL 0-160 PSI
21	21381436	TEE SS 1/4ODT x 1/4ODT x 1/4 TUBE
22	21495735	ECON TUBE
23	21381434	CONN SS 1/4ODT x 1/4FPT
24	13321014	PG DIAL 0-400 PSI
25	11940065	ELBOW SS 90D 1/4ODT x 1/4MPT
26	13154842	REGULATOR 1/4MPT @ 150 PSI

Carbo-Max 600 & 750 Flow Schematic



	<i>Description</i>
1	Vaporizer Coil - 3/8" OD SS Tubing
2	Liquid Fill Valve - 3/8" NPT
3	Tee Brass 1/2" FPT Forged
4	Economizer Regulator 1/4" NPT set @ 150 psig
5	Gas Use Pressure Gauge 0-160 psig
6	Final Line Regulator 1/4" NPT set @ 115 psig
7	Gas Supply Isolation Valve (on/off) 1/4" NPT
8	Storage Cylinder Pressure Gauge 0-400 psig
9	Differential Pressure Gauge
10	Primary Pressure Relief Valve set @ 300 psig (ASME rated)
11	Secondary Pressure Relief Valve set @ 450 psig
12	Outer Cylinder Pressure Protection set @ 23 psig

	<i>Description</i>
13	Venturi Fill Device
14	Vent Line 1/2" OD Copper Tubing
15	CO ₂ Fill Connection
16	Vent Line to Fill Box
17	CO ₂ Use Connection Isolation Valve 1/4" NPT (red-handled)
18	High Side Differential Pressure Isolation Valve 1/4" NPT
19	Sure-Fill™ CO ₂ Cylinder Filling System Automatic Vent Regulator 1/4" NPT set @ 200 psig
20	Sure-Fill Isolation Valve 1/4" NPT
21	Low Side Differential Pressure Isolation Valve 1/4" NPT
22	Economizer Isolation Valve 1/4" NPT
23	Emergency Shut-Off Label

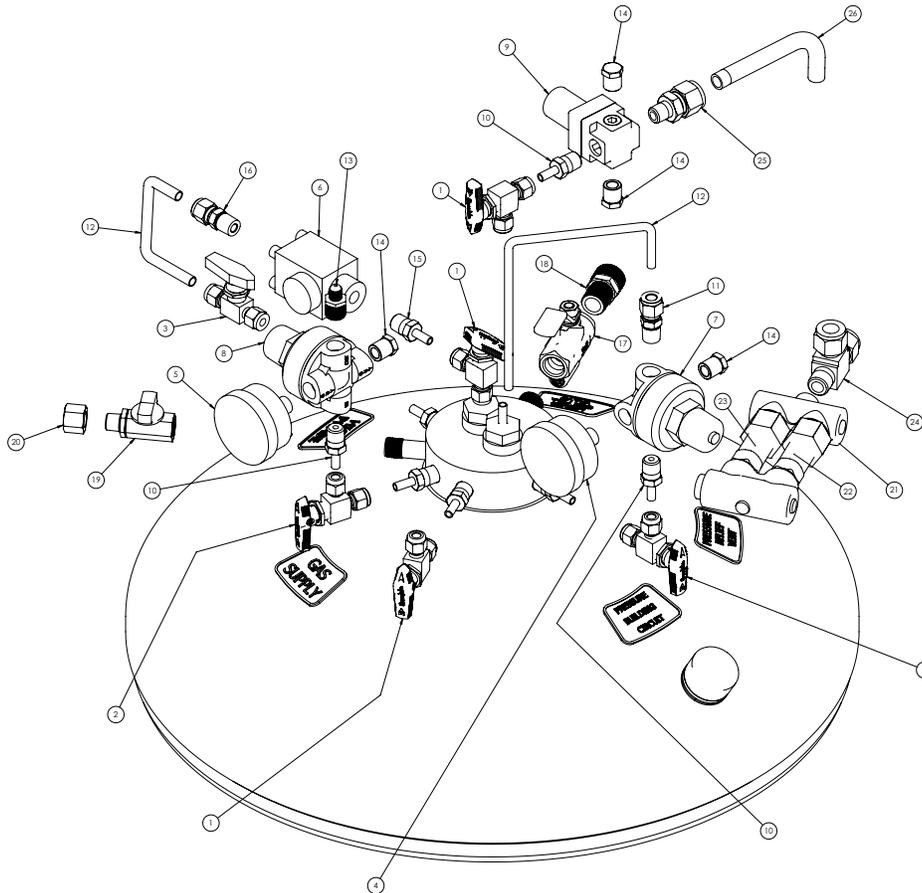
Carbo-Mizer® Specifications

	Mizer 300	Mizer 450	Mizer 550	Mizer 750
Diameter (in/cm)	20 / 50.8	20 / 50.8	22 / 55.9	26 / 66.0
Height (in/cm) (with legs) (w/o legs subtract 6 in)	55.63 / 141.3	71.8 / 162.6	72.9 / 185.1	73.9 / 187.0
Empty Weight (lb/kg)	216 / 98	273 / 124	318 / 144	430 / 195
Full Weight (lb/kg)	518 / 235	740 / 336	906 / 411	1221 / 554
Net Storage Volume (gal/ ltr)	32 / 122	50 / 189	63 / 238	85 / 320
CO ₂ Storage Capacity (lb/ kg) (saturated @ 125 psig (8.6 barg))	302 / 137	467 / 212	588 / 267	791 / 359
Gas Use Connection	1/4" 45° Flare			
Fill Line Connection	5/8" Male 45° Flare			
Vent Line Connection	1/2" OD Tubing			
Rates and Pressures				
CO ₂ Gas Delivery (continuous) (12 consecutive hrs @ room temp)	1 lb/hr (.5 kg/hr) (89 16 oz drinks/hr)*	5.5 lb/hr (2.5 kg/hr) (489 16 oz drinks/hr)*	6.5 lb/hr (2.8 kg/hr) (551 16 oz drinks/hr)*	10 lb/hr (4.5 kg/hr) (889 16 oz drinks/hr)*
Peak CO ₂ Gas Flow Rate (4 consecutive hrs & room temp)	3 lb/hr (1.4 kg/hr) (267 16 oz drinks/hr)*	10 lb/hr (4.5 kg/hr) (889 16 oz drinks/hr)*	10 lb/hr (4.5 kg/hr) (889 16 oz drinks/hr)*	15 lb/hr (6.8 kg/hr) (1333 16 oz drinks/hr)*
Liquid CO ₂ Delivery	On Demand	On Demand	On Demand	On Demand
Evaporation Rate (No loss in normal use)	2.0 lb/day (0.91 kg/day)	2.5 lb/day (1.1 kg/day)	2.5 lb/day (1.1 kg/day)	3.0 lb/day (1.4 kg/day)
MAWP	300 psig / 20.7 barg			
ASME Relief Setting	300 psig / 20.7 barg			
Additional Relief Setting	450 psig / 31.0 barg			
Sure-Fill™ CO ₂ Cylinder Filling System Relief Setting	200 psig / 13.8 barg			
Design Criteria	All Cylinders Above (unless noted otherwise)			
Design Specifications	ASME Section VIII, Division 1 / Meets with US and Canadian approvals			
Fill System	Single line, pressure differential			
Sure-Fill System	Recommended option			
Insulation Type	Vacuum with Super Insulation			
Pressure Control	Pressure Building Circuit			
Liquid Level Gauge	Differential Pressure standard			
Outer Cylinder Material	Stainless Steel			
Inner Cylinder Material	Stainless Steel			
Floor Mount Design (Meets NSF Standards)	Permanent Legs			

*Based on 11.25 lb of CO₂ / 1000 16 oz drinks

Carbo-Mizer Part Identification

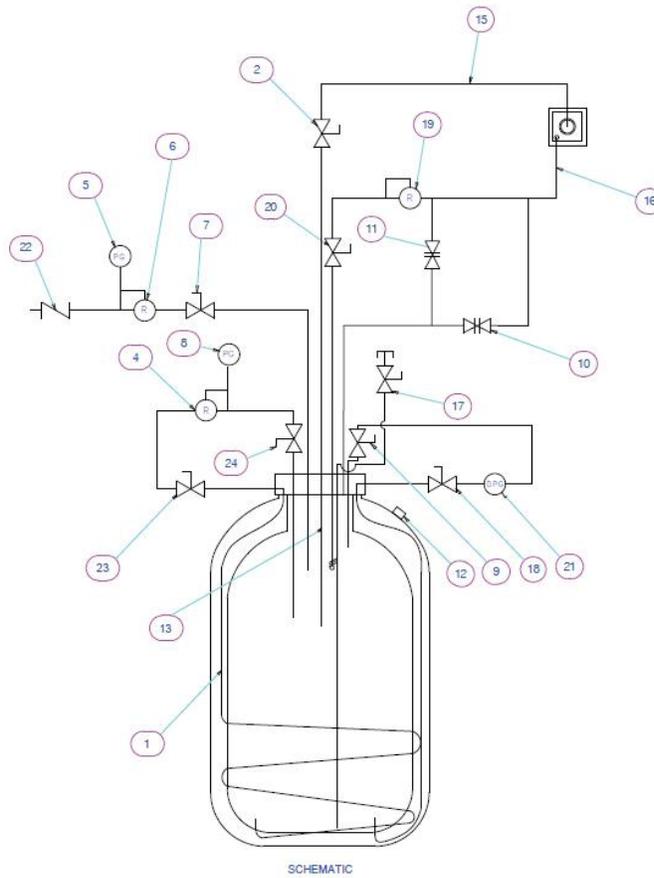
Equipped with Sure-Fill™ CO₂ Cylinder Filling System and DP style contents gauge.



Item	PN	Description
1	21367288	VALVE ISO 1/4 ANGLE BLACK HANDLE
2	21367289	VALVE ISO 1/4 ANGLE RED HANDLE
3	21367290	VALVE ISO 1/4 STRAIGHT BLACK HANDLE
4	13321014	PG 2" DIAL 0-400 PSI
5	13321006	PG 2" DIAL 0-160 PSI
6	21094533	DIFF PG 0-53"
7	21178189	REGULATOR @ 125 PSI - PRESSURE BUILDER
8	21178190	REGULATOR @ 115 PSI - GAS SUPPLY
9	13154834	REGULATOR @ 200 PSI - SUREFILL
10	21367286	TUBE ADAPTER 1/4"
11	10501247	CONNECTOR 1/4 OD x 1/4 MPT
12	20953805	TUBE SS 1/4" OD

Item	PN	Description
13	21368770	GAS USE CHECK VALVE
14	21367292	PLUG SS HEX 1/4"
15	21426621	CONNECTOR 1/4 TUBE x 1/8 MPT
16	21367294	CONNECTOR 1/4 OD x 1/8 MPT
17	20953805	VALVE BALL 3/8 NPT
18	21178190	CONNECTOR 5/8 OD x 3/8 MPT 45D FL
19	21368771	VALVE 150 NICKEL PLATED
20	21369782	CAP SS HEX 1/4 FPT
21	21303884	REGO MANIFOLD
22	11547714	RV 1/4 MPT 300 PSI
23	1812062	RV 1/4 MPT 450 PSI
24	13832906	TEE BRS M RUN 1/2 OD x 3/8 MPT x 1/2 OD
25	21178189	CONN BRS 1/2 OD x 1/4 MPT
26	14275919	TUBE SUREFILL

Carbo-Mizer Flow Schematic



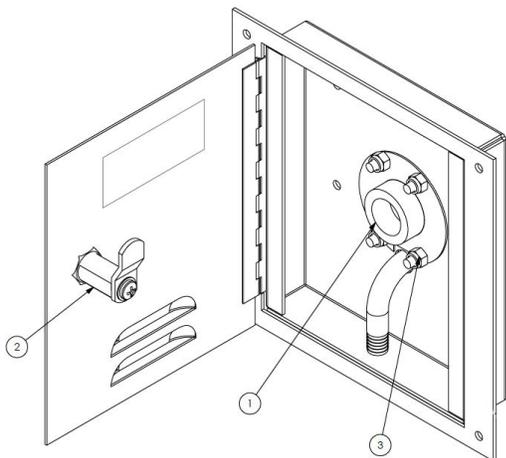
	Description
1	Pressure Building Coil - 3/8" OD SS Tubing
2	Liquid Fill Valve 3/8" NPT
3	Tee Brass 1/2" FPT Forged
4	Pressure Building Regulator 1/4" NPT set @ 125 psig
5	Gas Use Pressure Gauge 0-160 psig
6	Final Line Regulator 1/4" NPT set @ 110 psig
7	Gas Supply Isolation Valve (on/off) 1/4" NPT (Red Handled)
8	Storage Cylinder Pressure Gauge 0-400 psig
9	Low Side Differential Pressure Isolation Valve 1/4" NPT
10	Primary Pressure Relief Valve set @ 300 psig (ASME rated)
11	Secondary Pressure Relief Valve set @ 450 psig
12	Outer Cylinder Pressure Protection set @ 23 psig
13	Venturi Fill Device

	Description
14	Vent Line 1/2" OD Copper Tubing
15	CO ₂ Fill Connection
16	Vent Line to Fill Box
17	CO ₂ Liquid Use Isolation Valve 1/4" NPT
18	High Side Differential Pressure Isolation Valve 1/4" NPT
19	Sure-Fill™ CO ₂ Cylinder Filling System (Automatic Vent) Regulator 1/4" NPT set @ 200 psig
20	Sure-Fill Isolation Valve 1/4" NPT
21	Differential Pressure Gauge
22	Gas Use Check Valve CO ₂ 1/4" NPT
23	Pressure Building Isolation Valve Liquid Side 1/4" NPT
24	Pressure Building Isolation Valve Gas Side 1/4" FPT
25	Emergency Shut-off Label

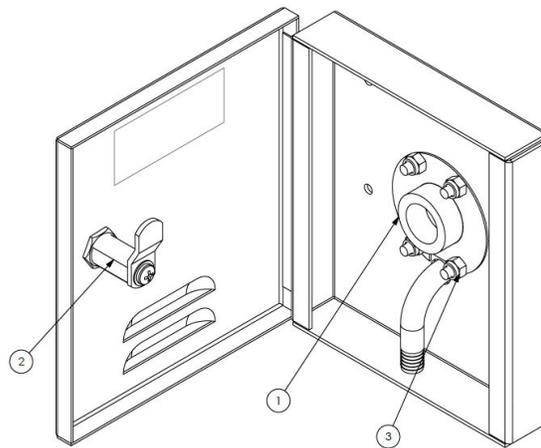
Other Specifications

Fill Box Parts

Flush-Mount Fill Box
PN 21430874 (3/8")



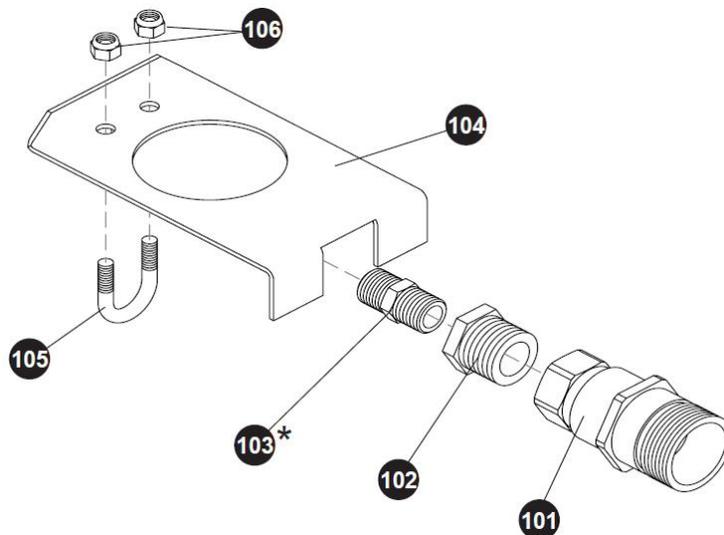
Surface-Mount Fill Box
PN 21430873 (3/8")



Item	PN	Description	Function
--	11784496	Caution Label	Advisory identification of CO ₂ use.
1	21126270	CO ₂ Fill Fitting, Brass	Connection for CO ₂ delivery cylinder hose.
2	13078181	Lock Assembly (includes key)	Locks fill box door.
--	13078173	Cam	
--	13104087	Key for Lock Assembly (not pictured)	Replacement key for fill box.
3	2914071	Locknut SS w/nylon Insert	Attach fill fitting to fill box studs.
4	21312110	Surface-Mount C02 Fill Box Shell (w/out fitting)	Allows outdoor filling and venting of cylinder.
5	21312111	Flush-Mount C02 Fill Box Shell (w/out fittings)	Allows outdoor filling and venting of cylinder.
6	21438406	Retaining Flange	Holds Fill Fitting in position

Direct Fill Components

"Direct Fill" Fitting Kit
PN 14905901
 (for outdoor installations only)



	PN	Description	Function
101	21207104	CO ₂ Fill Fitting, Brass (3/4" thread)	Fill port connection for CO ₂ delivery.
102	1212062	Hex Bushing (3/8" FPT x 3/4" MPT)	Joins fill fitting to hex nipple.
103	1310222	Pipe Nipple, Brass (3/8" NPT x 2")	Used to join fill fitting to valve on cylinder when bracket is used (recommended).
	or 1310072	or Hex Nipple (3/8" NPT x 1-1/4" long)(pictured)	
104	10724192	CO ₂ Fill Fitting Support Bracket	Prevents fill fitting from turning with fill (gun) coupling.
105	22239890	U-bolt	Secures fill fitting bracket to fill tube.
106	2914071	Locking Nut	Secures u-bolt to fill fitting bracket and fill tube.

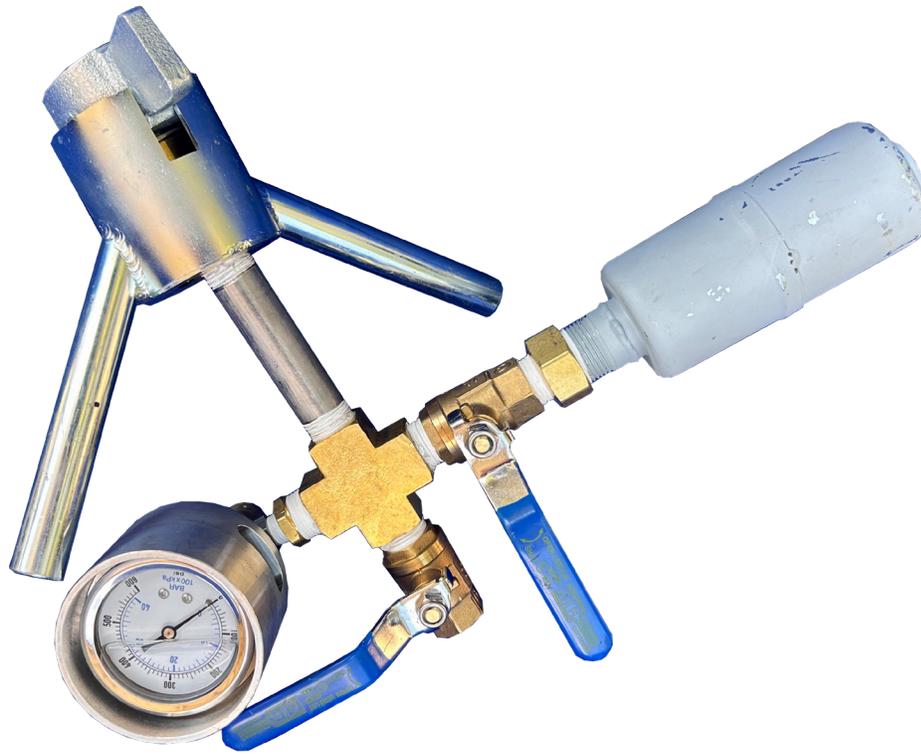
Fill and Vent Hose Kits

PN	Description
21432028	5 ft. Fill & Vent Hose
21432029	10 ft. Fill & Vent Hose
21432030	15 ft. Fill & Vent Hose

PN	Description
21432031	25 ft. Fill & Vent Hose
21432032	30 ft. Fill & Vent Hose
21432033	50 Ft. Fill & Vent Hose

Fill "Gun" Assembly CO₂

Fill Gun PN 21190956



**Contact Chart Parts for Individual replacement parts*

Service and Parts

Service or maintenance work on the bulk CO₂ storage system should be performed only by Chart trained and authorized professional service agents. These service agents are familiar with CO₂, bulk liquid CO₂ pressure cylinders, and all pertinent safety and service procedures. Chart recommends the use of Chart approved replacement parts. Contact Chart for the name of the authorized service agent(s) in your area.

Before calling for service or troubleshooting assistance, please have the following information at hand:

- Serial number of the cylinder
- Description of the problem
- Readings from:
 - the contents gauge
 - the cylinder pressure gauge
 - the final line pressure gauge
- Any special observations (for example: unusual frosting or events related to the problem)

Chart recommends that a qualified professional service agent perform a thorough preventive maintenance check on the system at least once every two years. The check should be done to ensure safety and optimal system performance.

The bulk CO₂ storage system has no user serviceable parts. An authorized professional service agent should perform all service work.



Note: Any attempt by an unauthorized person to service or perform unauthorized modifications on the equipment will void the warranty.

For parts contact your local authorized Chart service agent or order on-line directly from chart at www.chartparts.com.

Know the model and serial number of the cylinder for which you are ordering parts. To assure that your order is processed promptly, list each item separately, being careful to specify the quantity, the part number, and the description of each item being ordered.

Chart “Beverage” Customer Service: 1-800-247-4446

Chart “Beverage” Technical Service 1-800-253-1769

www.chartparts.com

Warranty

Warranty Policy

Chart Inc. (“Chart”) warrants to the Purchaser that the Bulk CO₂ Storage Systems equipment (the “Equipment”) shall be free from any defects in workmanship and materials; provided, however, that this warranty shall be limited to Equipment found to be defective within a period of one (1) year from initial use or eighteen (18) months from the date of shipment, whichever expires first, except that parts sold as a spare or for replacement are warranted for ninety (90) days from the date of shipment. Chart also warrants the vacuum in the Equipment for seven (7) years from the date of the original Chart invoice (as of 1/1/2016)(“**Pool Coat**” vessels **for three (3) years**). Chart warrants that its services will be performed in a professional and workmanlike manner. All Chart services are warranted for a period of ninety (90) days from the date of their completion.

Purchaser agrees that as a pre-condition to any Chart liability hereunder, Purchaser or its appointed agents shall fully inspect all Equipment immediately upon delivery and shall give Chart written notice of any claim or purported defect within ten (10) days after discovery of such defect.

As a further pre-condition to any Chart liability hereunder, an approved Chart service company must supply both parts replacement and labor and Purchaser must strictly adhere to the Warranty Claims Procedure set forth below. Chart’s sole and exclusive liability under this limited warranty is to the original Purchaser only and is, at Chart’s sole option: (1) repair or replacement of the defective Equipment or parts thereof; or (2) refund the net purchase price of the defective Equipment or parts thereof paid by the original Purchaser; or (3) in the case of nonconforming services, provide equivalent services or refund the net price paid by the original Purchaser for such services. Chart shall not be responsible for providing working access to the defect, including disassembly and reassembly of Equipment or for providing transportation to and from Chart’s repair or factory facility, all of which shall be at Purchaser’s risk and expense.

This limited warranty does not apply to Equipment that Chart determines to have been caused by the effects of normal wear and tear, erosion, corrosion, fire, flood, explosion or other excessive external forces, misuse, abuse, negligence or accident. Alterations or repairs by any party other than those designated and approved in writing by Chart, or installation, storage, maintenance or operation of such Equipment in a manner inconsistent with Chart accepted practices, normal operating instructions, specifications and drawings, or outside the specified design conditions, unless pre-authorized in writing by Chart, shall void this limited warranty. Modifications in any way to the Equipment without Chart’s prior written approval shall render this warranty void. This limited warranty does not apply to Equipment comprised of materials provided or a design stipulated by Purchaser or to Equipment purchased used. Negligent handling of the vacuum by the Purchaser or others, or testing of the vacuum levels by any party other than Chart designated and approved party shall render the vacuum warranty void.

Repairs or replacements made pursuant to warranty shall not renew or extend the applicable original warranty period; provided however, that any such repairs or replacement of Equipment or parts thereof shall be warranted for the time remaining in the original warranty period or thirty days, whichever is longer.

Individual parts replacements under warranty and with a component list price less than \$50.00 will be replaced at no charge. Individual components costs exceeding \$50.00 that are replaced under warranty will be invoiced to the Purchaser and the Purchaser will be issued credit based on results of Chart’s evaluation of the returned component(s). The Return Material Authorization (RMA) process must be initiated prior to shipment of any replacement parts.

Chart is not liable for component replacement labor exceeding two hours for actual replacement and two hours travel time. Contact Chart Customer Service for labor rate.

Chart specifically makes no warranties or guarantees, expressed or implied, including the warranties of merchantability of fitness for a particular purpose or use, or warranties arising from course of dealing or usage of trade, which are all expressly disclaimed, other than limited warranties expressly specified herein.

In no event shall Chart be liable for any special, indirect, incidental or consequential damages, including but not limited to loss of profits, lost opportunity, loss of use of the equipment, CO₂ loss, cost of capital, cost of substitute equipment, downtime costs, costs of delays nor for any penalties, whether any such claim for the same is based on contract, warranty, tort, negligence, strict liability or otherwise, Chart's liability for any such claims whether in contract, warranty, negligence, tort, strict liability, or otherwise or for any loss or damage arising out of, connected with, or from any design, sale, installation, operation or use of the equipment or performance of any services rendered by Chart, shall in no event exceed the purchase price paid to Chart by purchaser for the specific equipment or part thereof or for the services giving rise to the claim. Purchaser agrees to defend, indemnify and hold Chart harmless from any third party claims arising out the use, sale, or lease of the equipment.

This warranty policy is not intended to replace or supersede the warranties, limitations, exclusive remedy and disclaimers set forth in Chart's Terms and Conditions of Sale. In the event of a conflict between Chart's Terms and Conditions of Sale and this Warranty Policy, this Warranty Policy shall control.

Warranty Claims Procedure

1. All warranty claims must be previously authorized by Chart Inc. Telephone / electronic approval may be obtained by contacting Chart's Beverage Systems Technical / Customer Services at:

1-800-247-4446

1-800-253-1769

Fax: 1-952-758-8275

Or by writing to:

Chart Inc.

407 7th Street NW

New Prague, MN 56071

2. Authorization must be obtained from Chart prior to shipping any Equipment to Chart facilities. In order to process the return of a cylinder its model and serial number must be provided. If approved, a Return Material Authorization (RMA) number will be provided. The RMA number must be prominently indicated on the packing slip and any packaging that accompanies the goods being returned. The customer returning the goods is responsible for all freight, proper packing, and any damage incurred during shipment of the goods back to Chart.