Product Manual

Bulk CO_2 Supply Systems for McDonald's®
Carbo-Max® 450, 750 and 1000

Designed and Built by:

Chart Inc.

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Part Number 14347902 Rev. B

Contents

Revision Log

Revision Level	Date	Description
A	08/2012	Original
B	09/26/2016	Reformat and update to include Carbo-Max 1000; update warranty to 7 years

Safety

General

The system described in this manual holds and dispenses carbon dioxide (CO_2) 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 CO_2 gas. Avoid entering tank 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 tank. Stay away from escaping gas.***

Warning! ***CO_2 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.***

CO_2 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 CO_2 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 CO_2 can cause:

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

CO_2 is heavier than air and can collect in low areas such as basements, stairwells, and confined spaces. Avoid entry into areas where CO_2 leaks or high concentrations of CO_2 are suspected. Enter those areas with caution only after they have been thoroughly ventilated.

Whenever the tank 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 tank must not block emergency exits, aisles, fire suppression equipment or utility boxes or accesses. CO_2 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 CO_2 and the mini-bulk liquid CO_2 storage tanks. 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 CO_2, cold pipes / 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 tank 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 CO_2 storage tank is an ASME coded tank designed for permanent installation. It is not designed to meet DOT regulations and must not be transported when containing liquid CO_2. It must be shipped, stored and used in a vertical position to avoid structural damage. When loading a tank onto or off of a truck, use a power lift gate, crane, or an inclined ramp. Never attempt to manually lift or slide a tank on or off a truck bed.*

CO_2 Monitoring Systems

The Analox 50™ and Ax 50™ Carbon Dioxide Analyzers are precision instruments that provide continuous, accurate monitoring of CO_2 levels to ensure a safe working environment for your employees, suppliers and yourself.

A proven system with over 80,000 units installed worldwide. The Chart/Analox 50 Monitoring System is comprised of one detector (with visual and audible alarms) and one alarm repeater for remote mounting. The Chart/Ax 50 Monitoring System includes one detector, one alarm repeater and one relay for additional notifications.

For more information look for PN 13586611 on http://literature.chart-ind.com.

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 CO_2 concentrations without proper self contained breathing apparatus.
- Thoroughly ventilate areas of possible high CO_2 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

Introduction

System Overview

The Carbo-Max CO_2 system for McDonald's restaurants is designed for low pressure storage and supply of carbon dioxide gas for beverage carbonation and equipment operation. The supply system consists of three primary elements: the CO_2 storage tank, an outdoor fill box, and fill / vent lines.

Bulk CO_2 Storage Tank

The Carbo-Max CO_2 storage tank is the main component of the three primary elements in the CO_2 supply system. It consists of an inner tank and an outer tank, much like a giant Thermos® bottle. The space between the two tanks contains a nearly perfect vacuum and special insulation. The vacuum and insulation minimize the entry of unwanted heat into the liquid CO_2 stored in the inner tank. When CO_2 gas is needed, liquid CO_2 is withdrawn from the inner tank, converted to gas and dispensed to the beverage system or other use point.

Fill Box

The stainless steel fill box is the second major element of the bulk CO_2 storage system. The purpose of the fill box is to provide a convenient point to fill the storage tank, to make connections for syrup delivery, and to vent excess pressure from the tank out of the building. The fill box has a brass fill fitting, a connection for the safety relief vent circuit, a safety snap connection point, and a lockable door. Two standard types of fill boxes are available; a surface-mount model and a flush-mount model.

Fill boxes must be mounted outside the building where they are easily accessible to the CO_2 supplier and where they can safely vent excess CO_2 pressure outdoors. When a tank needs to be moved to accomplish a fill, a tank-mounted direct fill fitting and an alternative safety relief vent line are used instead of the fill box.

Fill Hose and Vent Line

The third major element of the stationary bulk CO_2 system is comprised of a fill hose and vent line. These lines join the outdoor fill box with the CO_2 storage tank. The fill hose, constructed with FDA compliant materials, is a pressure rated line that connects the brass fill fitting in the fill box to the fill valve on the tank. The vent line is as important as any component in the system. It connects the safety relief valves on the tank to either the outdoor fill box or an alternative outdoor vent tube.

Note: *The tank must always be connected to an outdoor vent line when it contains CO_2 and is indoors.*

Fill Circuit

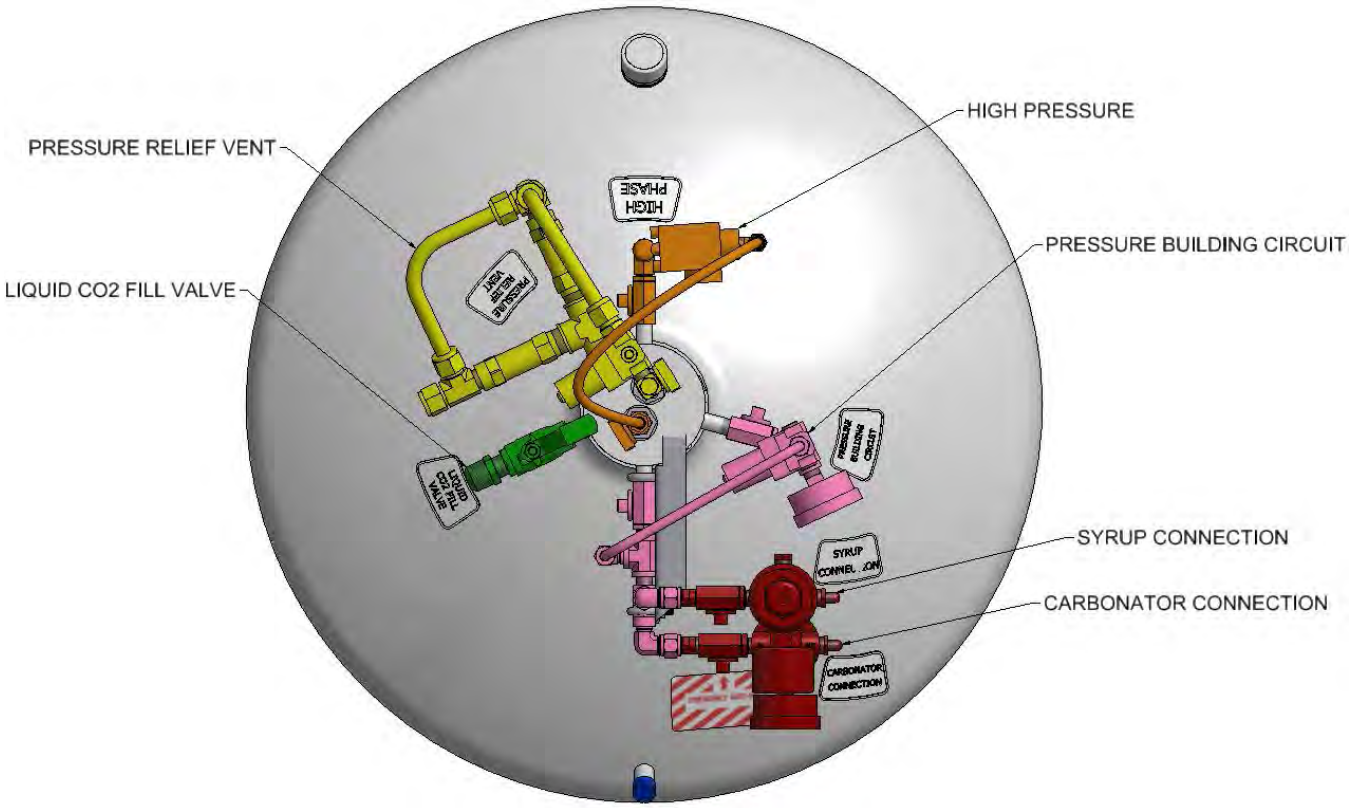
The stationary fill circuit consists of a brass fill fitting in a remote fill station (box), a fill hose, a valve on the tank, and a Sure-Fill pressure relief assembly. Liquid CO_2 is delivered to the tank through the brass fitting in the fill box and through the transfer hose to the tank. The shut-off valve on the tank's fill port allows service to be performed on the fill box / fill line segment of the fill circuit without emptying the tank. An optional direct fill circuit consists of a brass fill fitting and bracket secured to the fill port of the tank.

The Sure-Fill vent assembly enables fast, trouble-free filling without needing to manually vent excess pressure that develops during a CO_2 delivery. The Sure-Fill system automatically maintains the optimum internal pressure during the fill process by venting excess pressure outdoors through the safety vent and fill box. It also automatically stops the fill process when the tank is full.

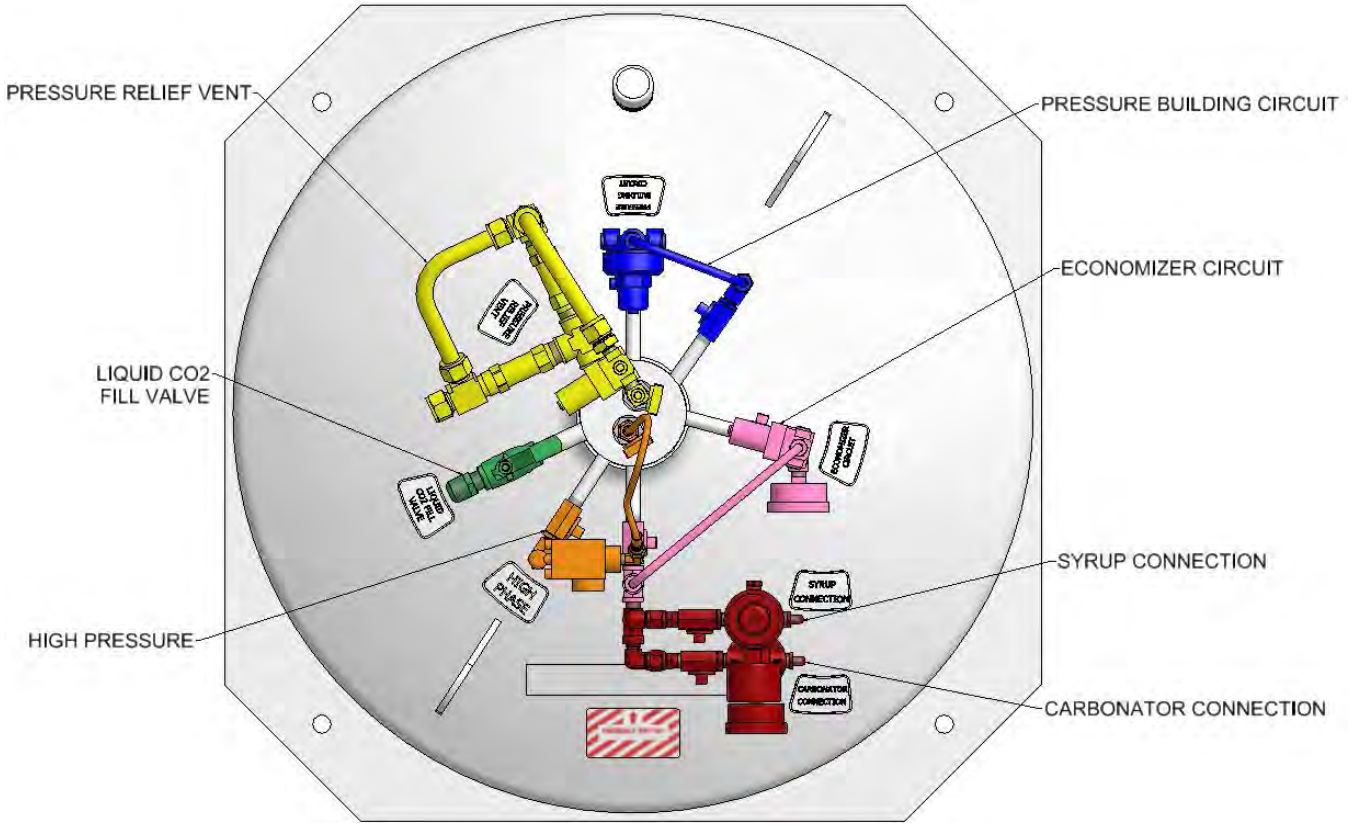
Gas Use Circuit

The gas-use circuit supplies gas to the carbonator, the syrup systems, and other beverage equipment. Liquid CO_2 stored in the tank is converted to gas in the vaporizer portion of this circuit. The CO_2 gas then passes through the shut-down circuit valve into the respective final line regulator and is dispensed to the end use point as needed.

Final line regulators in the gas-use circuit control gas flow to the beverage and syrup systems. The factory setting on the carbonator gas supply regulator is 110 psi but the pressure may be adjusted to suit the needs of the application. This regulator is commonly set between 90 psi and 115 psi for soft drinks. Secondary pressure regulators may be added 'downstream' for applications such as bag-in-box or diet systems. The syrup gas-use regulator is set at 65 psi for the syrup system. The use-point equipment manufacturer should be consulted for the correct regulator and pressure setting.



Carbo-Max 450 / 750



Carbo-Max 1000

Tank Plumbing

Plumbing components on the tank perform five functions:

1. The fill connection allows liquid CO_2 to be transferred into the tank during the delivery process.
2. The gas-use circuit dispenses CO_2 gas to the end use system.
3. The pressure control circuit, the economizer maintains optimal operating pressure and conserves gas for efficient system performance. The Carbo-Max 1000 also has the pressure building circuit from the Carbo-Mizer® Series.
4. The relief/vent circuit allows excess pressure to safely exit the tank and the building. The Sure-Fill™ CO_2 Tank Filling System assembly is a standard feature on the Carbo-Max 450, 750 and 1000.
5. Contents and pressure gauges monitor the status of the CO_2 inside the storage tank.

Pressure Control Circuit

The pressure control circuit, also called the "Economizer" circuit, assists in regulating the internal operating pressure of the tank. Adequate tank pressure is needed for supplying CO_2 gas and for preventing the stored liquid carbon dioxide from changing to dry ice, the solid form of CO_2. However, internal pressure that is too high can cause venting, wasted gas, and difficulties refilling the tank. The economizer circuit is designed to prevent excess pressure and the waste of CO_2 gas.

The "Economizing" process is controlled by a regulator that monitors the tank's internal pressure. When the tank pressure exceeds the set point of the regulator (factory set at 140 psi) the regulator opens allowing CO_2 gas to flow directly into the gas use circuit whenever CO_2 gas is being used. By taking excess gas from the top of the tank instead of converting liquid from the bottom, the internal pressure of the tank is reduced and controlled.

The pressure control circuit maintains optimal operating pressure and conserves gas for efficient system performance.

Safety Vent Circuit

The inner pressure tank of this storage system is designed to meet or exceed the ASME Section VIII, Division 1 pressure tank code. The code indicates that the tank be protected against excess pressure by a safety relief valve. Chart uses two safety relief valves for added safety. The tank's safety circuit is comprised of an ASME relief valve set at 300 psig and an additional relief valve set at 450 psig. The relief valves must always be vented outdoors by a vent tube, usually through the fill box, to prevent potential concentration of CO_2 within the building. The 300 psig relief valve may open during CO_2 deliveries or when CO_2 is not being used regularly.

Pressure and Contents Gauge

The tank pressure gauge measures the pressure in the top (gas space) of the inner tank. The normal operating pressure range is 140 to 165 psig though pressures up to 300 psig may be seen for a short period after a tank fill.

The tank's contents gauge is a mechanical device that uses pressure to measure liquid level inside the tank. The measurement is accomplished by comparing two pressures, "low phase" and "high phase". The low phase pressure consists of the tank's gas space pressure. The high phase pressure consists of tank pressure plus pressure created by weight of the liquid inside the tank. The difference between the high and low phase pressures is translated by the gauge mechanism to a dial reading displaying the quantity of liquid CO_2 inside the tank.

The Bulk CO_2 Supplier

The bulk CO_2 supplier is also an important part of the system. Most CO_2 suppliers not only provide timely delivery of CO_2 but also install and service the system.

For service, parts, information, emergency CO_2 delivery, or other CO_2 related assistance, contact the local Chart authorized CO_2 supplier. A place has been designated in Specifications section of this manual to record the name and phone number of the CO_2 supplier and other important service contact information.

Installation

Equipment Location

Site Survey

Prior to installation of the CO_2 system components, a site survey should be performed to determine the best location for placing the bulk CO_2 tank and the fill station. As a matter of safety, this would be a good time to determine the proper location for a CO_2 monitor (CO_2 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 CO_2 tanks should be installed outdoors in an unenclosed space whenever possible. Tanks should not be installed on roofs, in basements, or below grade. Tanks should have foundations or floors capable of supporting the full weight of the tank plus product. Tanks 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 CO_2 tank. 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. The fill box may be located in a drive-thru lane and the fill hose may be driven over when it is pressurized during the filling operation.

When 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 tank 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 tank must not block emergency exits, aisles, fire suppression equipment or utility boxes or accesses. CO_2 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.

Storage Tank Location

Once the fill box location has been defined, the location of the CO_2 storage tank can be determined. The primary considerations for placing the storage tank are space and distance from the fill box. The storage tank must be placed as close to the fill box as possible to maximize filling efficiency; ideally within 25 feet. The distance from the storage tank to the beverage machine or other use point is not critical.

The storage tank 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 tank 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. Tanks installed outside near traffic should have protective bollards or guards installed. Check local codes for specific requirements.

Note: *To prevent damage to the tank's plumbing components the tank'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 CO_2 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. Chart authorized distributors or installation agents have the installation tools and supplies necessary for proper installation.

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

Hardware	Chart PN
Clamps for 1/4" ID Tubing	3411321
1/4" Hose Barb Nipple	1611481
1/4" Female Flare Nut	1611471
1/4" Hose Barb x 1/4" Female Elbow	1611461
Flare Nut Connector	1111222
1/4" ID Beverage Tubing	2811416
Concrete Wedge Anchor	
Hilti Kwik-Bolt® (3/8" x 3-3/8")	10559713
or	
Red Head True Bolt®	11557752

Note: *Stainless steel fittings should be used.*

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.

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 CO_2 storage tank 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 CO_2 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

1. 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.*

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

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.*

Run Lines to Tank Location

1. Feed the fill and vent lines through the wall (or PVC wall flange if used) to the inside of the store.
2. Re-attach the fill box if necessary.
3. If sleeve material is not being used, route lines to the tank location according to plan and attach them to the wall with conduit straps about every 2 or 3 feet. Proceed to CO_2 storage tank installation.
4. 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.*

5. Feed the fill and vent lines through the PVC sleeve conduit and run the sleeve conduit to the CO_2 storage tank.
6. Attach the PVC sleeve to the wall with conduit straps. Proceed to CO_2 storage tank installation.

CO_2 Storage Tank Installation

The bulk CO_2 storage tank 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 tank should be positioned so its plumbing components are accessible for service and so its gauges are facing "forward" and are readable.

Caution! The storage tank must be vented to the outside to prevent hazardous CO_2 concentrations from developing if a pressure relief valve should open.

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

Note: *Anchor bolts such as Hilti Kwik-Bolt® (Chart PN 10559713) or Red Head True Bolt® (Chart PN 11557752) wedge anchors may be used.*

1. Place the tank in its best position and mark three floor-anchor holes through the holes in the bottom of the legs. Move the tank.
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 tank 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 CO_2 Storage Tank

Bulk CO_2 storage tanks contain positive CO_2 gas pressure when they are shipped. Before installing the lines onto the tank, 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 tank, then open the tank valve.
2. Squarely cut the vent tubing to the proper length and attach the tubing to vent the circuit fitting of the tank.
3. Connect the supply line tubing to the tank's supply regulator.

Note: *Do not use copper tubing for CO_2 gas supply.*

For best results, the tank 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 CO_2 storage tank to the beverage equipment or other end use point(s) will probably be run differently in each location. The distance from the CO_2 tank 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. Refer to 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 CO_2 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, CO_2 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 CO_2 storage tank's final line (supply) regulator and to the drink system equipment using appropriate fittings.
5. Open the gas-use isolation valve on the bulk CO_2 storage tank 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 CO_2 pressure. The bulk CO_2 storage system supplies a pre-set CO_2 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 CO_2 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 CO_2 Storage Tank

First Fill

The first fill of the tank cools the inner tank of the storage system. Since the inner tank of a new CO_2 storage tank is relatively 'warm,' its first fill may take 20 to 30 minutes and a larger than normal amount of CO_2 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 tank equipped with the Sure-Fill™ CO_2 Tank Filling System option proceed to step 7.
4. Open the liquid delivery valve to allow liquid CO_2 to flow into the tank. CO_2 will stop flowing when the tank's pressure equals the pressure of the delivery source. At this point the tank 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 tank. Drop the tank pressure to between 100 and 125 psi (frost should be seen at the bottom of the tank). Close the vent valve.
6. Repeat the liquid delivery and vent cycle as often as necessary to get the tank contents to about 350 pounds on the 450 pound model.

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 tank about halfway and then return in a day or two to complete the fill.*

7. When filling a tank 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 CO_2 to flow into the tank. The Sure-Fill vent valve will open when the tank 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 tank is full. Disconnect the fill hose from the fill station.
10. Using a leak check solution check all connections and fittings on the tank and fill box for leaks. Tighten connections if necessary.

General CO_2 Delivery

To minimize delivery expense, delivery frequency should be scheduled to allow a 200-500 pound delivery; depending on tank 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 50 psi higher than the restaurant storage tank 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 CO_2 consumption.
4. Adjust delivery program to longer intervals between deliveries as consumption justifies.

Operation Facts

1. The McDonald's Carbo-Max tank's normal internal operating pressure is between 115 psi and 165 psi.

2. Tank 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 CO_2 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 carbonator gas supply pressure is normally between 90 psi and 115 psi.

4. The syrup gas supply pressure is normally 65 psi.

5. Frost or condensation on the tank is normal during periods of CO_2 use.

6. Frost or condensation on the tank before the start of daily CO_2 use is a sign of a CO_2 leak. Have the leak fixed.

7. A Carbo-Max 450 holds 453 lb of CO_2 for a use rate of approximately 70 to 100 lb per week.

   A Carbo-Max 750 holds 771 lbs of CO_2 for a use rate of 50 to 300 lbs per week.

   A Carbo-Max 1000 holds 1000 lbs of CO_2 for a use rate of 70 to 400 lbs per week.

8. The contents gauge displays the amount of liquid CO_2 in the tank.

9. CO_2 becomes dry ice below a pressure of 61 psi. The shut-off circuit regulator will close and stop CO_2 flow if the tank pressure reaches 70 psi or less.

10. 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. During normal use, all isolation valves on the Carbo-Max tank should be in the open position.

11. See the Troubleshooting section for additional information on potential tank problems.

General Operating Notes

1. Check for the following unusual symptoms every day before the start of operations and CO_2 use:
   - CO_2 leaks (see the Safety section)
   - Pressure readings
   - CO_2 contents
   - Abnormal frost or condensation

2. Always use caution when working with CO_2. Read and understand the "Safety" section of this manual.

3. The CO_2 storage system does not require adjustment under normal operating conditions.

4. Check the tank daily before using CO_2. See 'Operation Fact' number 10.

5. In an emergency the flow of CO_2 from or through the Carbo-Max can be stopped by closing the red-handled valves.

6. For CO_2 equipment issues, call your CO_2 supplier or service specialist. Before calling for service or troubleshooting assistance, please have the following information at hand:
   - Serial number of the tank
   - Description of the problem
   - Readings from:

     the tank contents gauge,
     the tank pressure gauge, and
     the final line pressure gauge
   - Observations such as unusual frosting and/or events related to the problem

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 syrup system. OR Carbonated drinks are flat.	CO_2 storage tank is empty.	Switch to emergency CO_2 gas cylinder. Call CO_2 supplier for delivery
	Isolation valves closed.	Open valve or valves as required.
	Tank pressure is low (110 psi or less).	Check for leak in gas supply lines, beverage system, tank plumbing, tank safety system and/or fill box. (Frost should not be present on tank after extended periods of no CO_2 use.)
	On Carbo-Max 1000 tanks, pressure building regulator is not operating properly, is set too low, plugged, or faulty	Ensure that isolation valves are open (valve handles should be parallel with the line). Call CO_2 service agent.
	Economizer regulator not operating properly; set too low or stuck open.	Check Economizer circuit by closing isolation valve and switching to emergency CO_2 gas cylinder. If pressure increases after 24 hours, the Economizer regulator may need to be replaced. If tank pressure fails to rise, refer to section below on "Constant Low Tank Pressure" and call CO_2 service agent.
	Unknown	Call CO_2 service agent.
Constant low tank pressure (gauge below 125 psi for PB on Carbo-Max 1000 and 150 psi for Econ)	Economizer regulator set low or stuck open.	Call CO_2 service agent.
	CO_2 leak from tank plumbing, CO_2 fill box and/or tank safety system.	See Safety section. Evacuate and ventilate the room. Call CO_2 service agent.
	PB shut-off valve closed	Open valve by turning handle parallel to line.
	Sure-Fill™ CO_2 Tank Filling assembly leaking or malfunctioning.	Close Sure-Fill valve. Call CO_2 service agent.
Frost on the bottom, sides, or top of the tank.	A normal condition during or following CO_2 use.	None
	Leak in beverage system and/or gas supply lines or CO_2 fill box. (When frost is present after extended periods of no CO_2 use)	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 tank after extended periods of no CO_2 use; such as in the morning before store operations begin.	CO_2 leak from the beverage or syrup system (rupture disc), plumbing, or CO_2 fill box.	See Safety section. Evacuate and ventilate the room. Call appropriate service agent.
Constant high tank pressure (over 200 psi)	Normal condition for a few days following a CO_2 delivery.	None
	Normal when little or no CO_2 is used.	None
	Economizer regulator closed or set too high.	Call CO_2 service agent.
	Tank has a weak vacuum.	Call CO_2 service agent.

Trouble	Probable Cause	Remedy
Constant high tank pressure (over 200 psi) (continued)	On Carbo-Max 1000, PB regulator set too high or stuck open.	Call CO_2 service agent.
High CO_2 consumption.	Increased beverage sales or CO_2 use.	None
	Tank pressure constantly high.	See section on tank pressure too high.
	CO_2 leak from tank 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 tank will not fill.	CO_2 tank is already full.	None
	Fill valve is shut off or is faulty.	Consult CO_2 service agent / open fill valve.
	Sure-Fill™ Tank Filling valve is closed.	Consult CO_2 service agent / open Sure-Fill valve.
	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.
	Differential between store tank pressure and delivery pressure is too small.	Verify delivery tank pressure is at least 50 psi higher than the store tank pressure and store tank pressure is between 105 to 155 psi. Vent store tank to lower pressure if needed (never vent store tank pressure to lower than 125 psi).
	Delivery tank is empty.	Consult supplier. Arrange for another delivery.
	Delivery tank 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.
	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 gauges indicate less than 65 psi on the syrup side and/ or less than 100 psi on the carbonator side.	Final line regulators intentionally set lower by beverage service agent.	None
	Final line regulators 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," "flat drinks" etc. Call CO_2 service agent.

Fill Box Troubleshooting

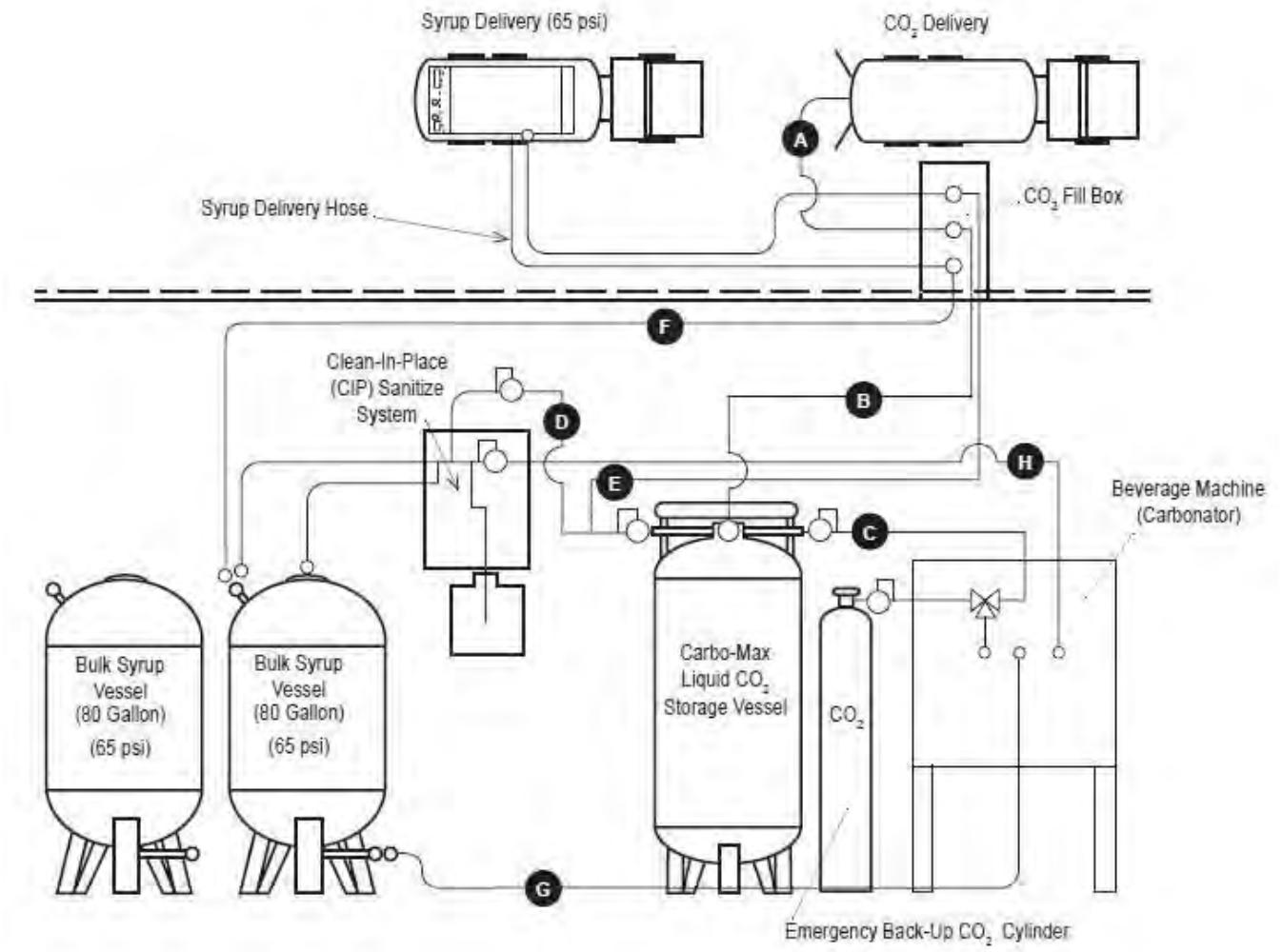
Trouble	*Probable Cause*	*Remedy*
Fill box door will not close, lock, or open.	Wrong key.	Verify correct key and retry. Contact CO_2 supplier for spare key. Order new key.
	Lock dirty or damaged	Clean and oil lock Replace lock if necessary
Brass fill fitting in fill box leaking or hissing.	Particle of 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 tank 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 tank is at or over 300 psi.	None if for short period(s) of time. If tank pressure is consistently over 300 psi, see section on “tank pressure too high.”
	Fill fitting is not sealing properly.	Call CO_2 service agent to replace fitting.

Specifications

	Carbo-Max 450	Carbo-Max 750	Carbo-Max 1000
Diameter (in/cm)	20 / 50.8	26 / 66.0	30 / 76.2
Height (in/cm)	71.8 / 182.0	73.9 / 187.6 (with legs add 5-1/2")	72.5 / 184.2
Empty Weight (lb/kg)	273 / 124	430 / 195	788 / 357.4
Full Weight (lb/kg)	726 / 329	1219 / 552.9	1788 / 811.0
Net Storage Volume (gal/ltr)	48 / 182	82 / 310.0	118 / 446.6
CO_2 Storage Capacity at 125 psig	453 / 205	789 / 357.9	1000 / 453.6
Gas Use Connection	1/4" 45° Flare		
Fill Line Connection	5/8" Male 45° Flare		
Vent Line Connection	1/2" OD Tubing		5/8" OD Tubing
Rates and Pressures			
CO_2 Gas Delivery (continuous) (12 consecutive hrs @ room temp)	15 lb/hr (6.8 kg/hr) (850 16 oz drinks/hr)*	15 lb/hr (6.8 kg/hr) (1333 16 oz drinks/hr)*	30 lb/hr (13.6 kg/hr) (3000 16 oz drinks/hr)*
Peak CO_2 Gas Flow Rate (4 consecutive hrs & room temp)	15 lb/hr (6.8 kg/hr) (850 16 oz drinks/hr)*	18 lb/hr (8.2 kg/hr) (1600 16 oz drinks/hr)*	60 lb/hr (27.2 kg/hr) (6000 16 oz drinks/hr)*
Evaporation Rate (No loss in normal use)	2.5 lb/day (1.1 kg/day)	3.0 lb/day (1.4 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 Tank Filling System Relief Setting	200 psig / 13.9 barg		
Design Criteria			
Design Specifications	ASME Section VIII, Division 1 / Meets with US and Canadian approvals		
Fill System	Single line, pressure differential		
Sure-Fill System	Standard		
Insulation Type	Vacuum with Super Insulation		
Pressure Control	Pressure Relief (Economizer)	Pressure Relief (Economizer) circuit on Max 750 / Pressure Building Circuit on Max 1000	
Liquid Level Gauge	Differential Pressure Standard		
Outer Tank Material	Stainless Steel		
Inner Tank Material	Stainless Steel		
Floor Mount Design (Meets NSF Standards)	Permanent Legs Max 450 & 750 / Base with 6" Legs Max 1000		

**Based on 11.25 lb of CO_2 / 1000 16 oz drinks*

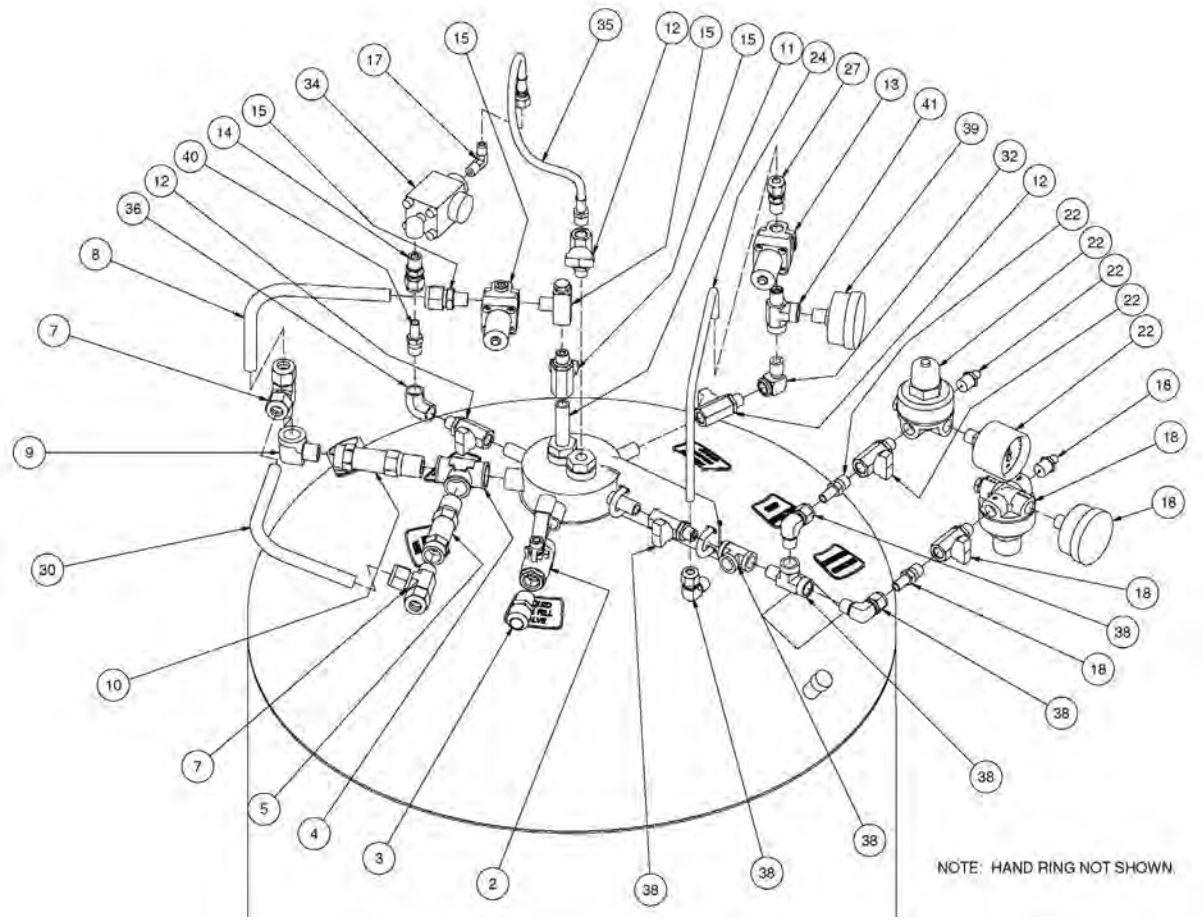
McDonald's Beverage System Layout



Item	Description	Function
A	CO_2 delivery truck fill line	Periodic transfer of liquid CO_2 to on-site storage tank
B	In-store CO_2 fill line	Transfer of CO_2 from outside fill box to storage tank
C	CO_2 gas use line to beverage machine carbonator	CO_2 gas supply at 90 - 110 psi for beverage carbonation
D	CO_2 gas use line to bulk syrup and CIP	CO_2 gas supply at 65 psi to push syrup to beverage machine
E	CO_2 gas use line to fill box 2-pin connection	CO_2 gas supply at 65 psi to pressurize bulk syrup delivery
F	Syrup delivery line	Bulk syrup delivery line routed through fill box conduit
G	Syrup supply tubing	Transfers syrup from bulk storage tank to beverage machine
H	Water supply line	Supplies water to beverage machine and sanitation (CIP) system
44	Syrup side gas use regulator (65 psi)	Controls CO_2 pressure to bulk syrup
45	Beverage side gas use regulator (90-125 psi)	Controls CO_2 gas pressure to carbonator

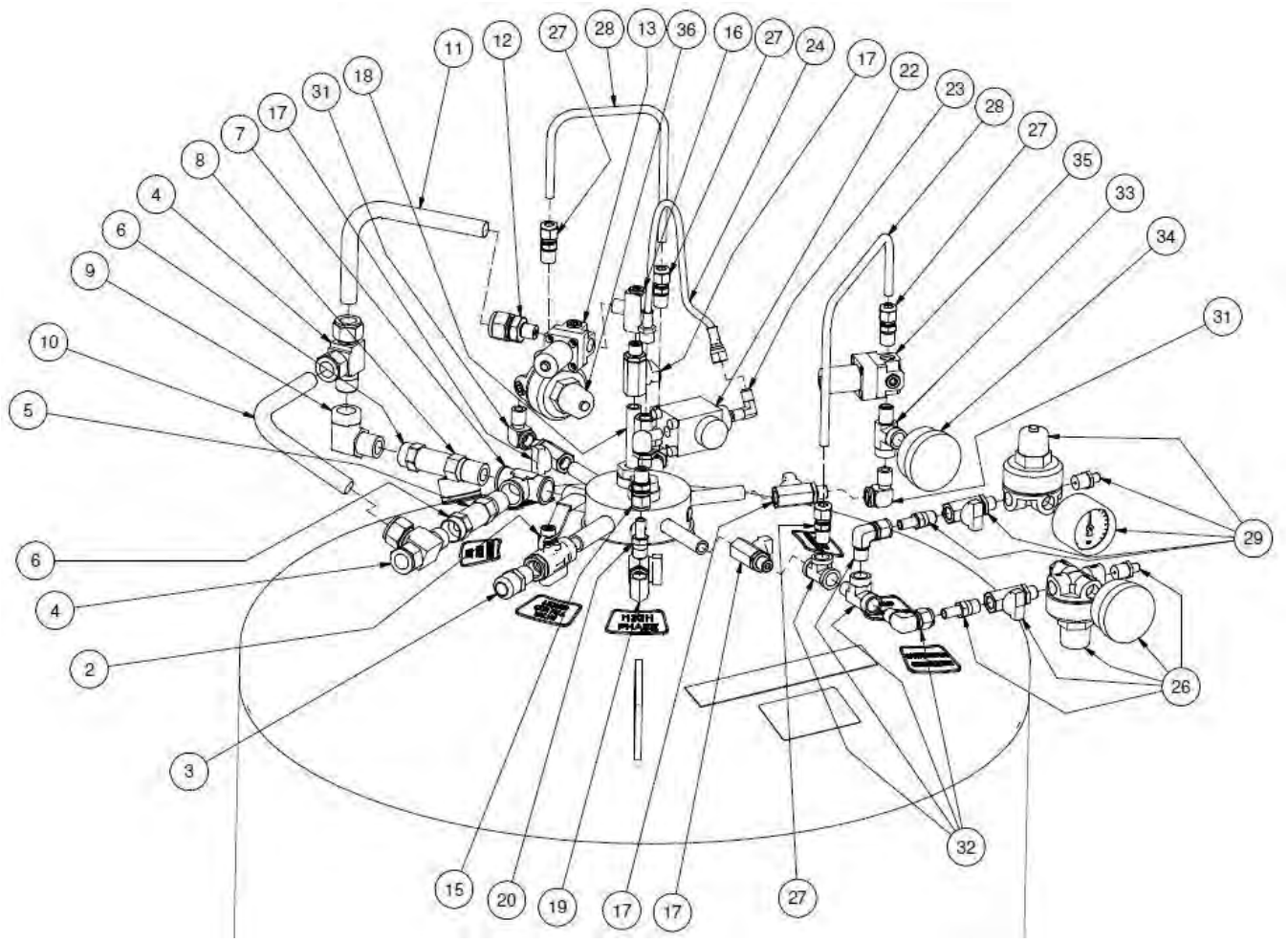
Parts Identification

Carbo-Max 450 & 750



Item	Part Number	Description	Item	Part Number	Description
2	14422693	Fill Valve 3/8" NPT w/Check	18	14396000	McD Final Line Plumbing S/A
3	1110112	Connector Brass 3/8" MPT x 5/8" ODT FL	22	14396026	McD Syrup Plumbing S/A
4	11044869	Forged Tee Brass 1/2" NPT	24	13669731	Stainless Steel Tube Econ and PB Lines
5	11708400	Relief Valve Brass 300 psi ASME	27	13833757	Connector Stainless 5/16" ODT x 1/4" MPT
7	13832906	M Run Tee Brass 1/2" ODT x 3/8" MPT	30	13799843	Copper Tube Relief/Vent Line
8	14275419	Copper Tube Sure-Fill™ Vent Line	32	1210462	Street Elbow Brass 90° 1/4" MPT
9	1210482	Street Elbow Brass 90° 3/8" NPT	34	15076542	Differential Pressure Gauge 1/8" FPT 0-53"
10	11708451	Relief Valve Brass 450 psi (Secondary)	35	20754903	Flex Hose Stainless x Brass 1/4" MPT x FPT
11	11764313	Sure-Fill S/A	36	1210402	Elbow Brass 90° 1/4" FPT
12	20733160	Isolation Valve Brass 1/4" NPT	38	14396042	McD Gas Use Connection Plumbing S/A
13	13154842	Regulator Economizer @ 150 psi .250 NPT	39	13321014	Pressure Gauge Tank Pressure 0-400 psi
14	13670994	Connector Brass 3/8" ODT x 1/4" MPT	40	15057974	Adapter Brass 3/8" ODT x 1/4" MPT
15	13393931	Sure-Fill Regulator and Tee S/A	41	14175021	Street Tee Brass 1/4" NPT
17	14339136	Elbow Brass 90° 1/8" ODT x 1/8" MPT	42	20645012	Gas Use Check Valve CO_2

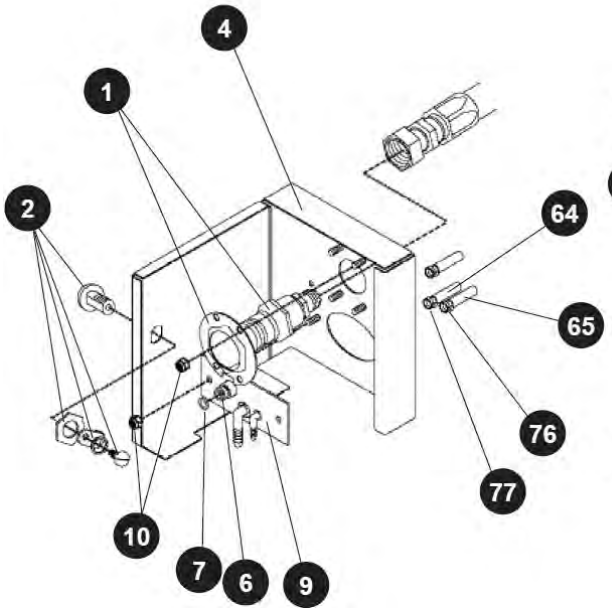
Carbo-Max 1000



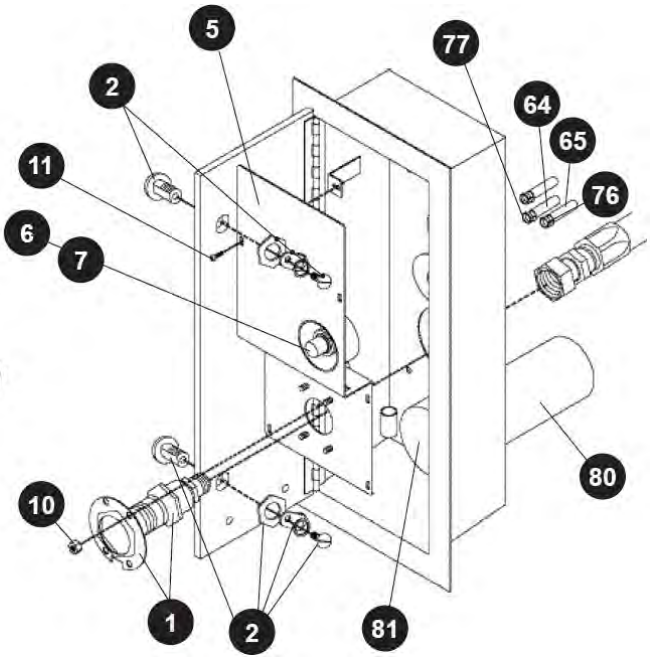
Item	Part Number	Description	Item	Part Number	Description
2	14422693	Fill Valve Brass w/Check 3/8”	19	1210402	Elbow Brass 90° 1/4” FPT
3	1110112	Connector Brass 3/8” MPT x 5/8” ODT FL	20	15057974	Adapter Brass 3/8” ODT x 1/4” MPT
4	20701607	M Run Tee Brass 5/8” ODT x 1/2” MPT	22	15096551	Differential Pressure Gauge 1/8” FPT 0-50
5	11708400	Relief Valve Brass 300 psi ASME	23	14339136	Elbow Brass 90° 1/8” x 1/8” MPT
6	1810092	Relief Valve Pipe-Away Brass 1/2” NPT	24	20754903	Flex Hose Stainless x Brass 1/4” MPT x FPT
7	11044869	Forged Tee Brass 1/2” NPT	26	14396000	McD Final Line Plumbing S/A
8	11708451	Relief Valve Brass 450 psi (Secondary)	27	13833757	Connector Stainless 5/16” ODT x 1/4” MPT
9	10791820	Elbow Brass 90° 1/2 FPT x 1/2 MPT	28	13669731	Stainless Steel Tube Econ and PB Lines
10	20701610	Copper Tube Relief/Vent Line	29	14396026	McD Syrup Plumbing S/A
11	20701611	Copper Tube Sure-Fill™ Vent Line	31	1210462	Street Elbow Brass 90° 1/4” MPT
12	20750775	Connector Brass 5/8” ODT x 1/4” MPT	32	14396042	McD Gas Use Connection Plumbing S/A
13	13154834	Regulator Sure-Fill @ 200 psi .250 NPT	33	14175021	Street Tee Brass 1/4” NPT
15	13670994	Connector Brass 3/8” ODT x 1/4” MPT	34	13321014	Pressure Gauge Tank Pressure 0-400 psi
16	1213092	Tee Brass 1/4” FPT x 1/4” FPT x 1/4” MPT	35	13154842	Regulator Economizer @ 150 psi .250 NPT
17	20733160	Isolation Valve Brass 1/4” NPT	36	14743180	Regulator Pressure Builder @ 125 psi .250 NPT
18	15071274	Sure-Fill S/A			

Fill Box Parts

Surface Mount Fill Box (PN 9722329)



Flush Mount Fill Box Shell (w/o panel)(PN 8512629)
Flush Mount Fill Panel (w/fittings)(PN 9722859)

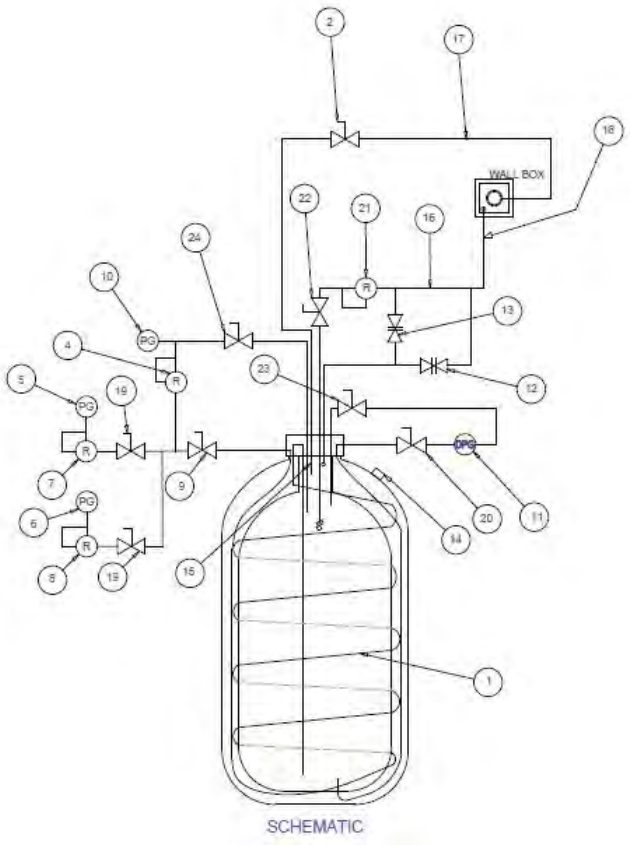


Item	PN	Description	Qty	Function
1	11381021	CO_2 Fill Fitting, Brass (includes retainer ring)	1	Connection for CO_2 delivery tank hose
2	13078181	Lock Assembly (includes key)	1	Locks fill box door.
--	13104087	Key for Lock Assembly (not pictured)		Replacement key for fill box.
4	12943786	Surface-Mount CO_2 Fill Box Shell (without fittings)	1	Allows outdoor filling and venting of tank.
5	8517839	Flush-Mount Fill Box Panel (without fittings)	1	Holds brass fill fitting and 2-pin connector
6	6511631	Quick Connect, 2-Pin	1	CO_2 connection for syrup delivery
--	4710619	O-Ring on boss adapter (not shown)	1	Seals 2-pin connection to boss adapter
7	10526989	Outside O-Ring (5/16" x 1/2")	1	Seals 2-pin connection for syrup delivery gas
9	12943866	Fill / Vent Connection Plate / without 2-pin Quick Connect	1	Removable plate for service to tubing connections
10	2914071	Locknut, SS (10x32) with nylon insert	--	Secures fill fitting retainer and connection plate
11	2913981	Screws, SS (#8 x 1/2")	6	Secures fill panel to fill box
64	2811606	Tubing, red line (1/4" ID)	20 ft	(Included in installation kit PN 9722439)
65	2811616	Tubing, green line (1/4" ID)	5 ft	(Included in installation kit PN 9722439)
76	3411511	Clamp, Stepless (for 1/4" ID green line tube)	6	(Included in installation kit PN 9722439)
77	3411321	Clamp, Stepless (for 1/4" ID red line tube)	4	(Included in installation kit PN 9722439)
80	8503796	Conduit, Syrup Pass-Thru	1	(Included in installation kit PN 9722439)
81	10772160	Pipe Cap 2-1/2" PVC	1	Syrup pass-thru cover (Included with PN 8512629)
--	11784496	Label, Caution Carbon Dioxide	1	
--	10789851	Decal, McDonald's Fill Box	1	
--	20596403	Kit McDonald's Vent Line Fittings	1	Connects 1/2" vent hose to pressure relief device outlet
--	20596458	Vent Hose 1/2" CO_2 McDonald's Green 300 ft.	1	Full roll of 1/2" ID vent line

Item	PN	Description	Qty	Function
--	20596399	Kit 5 ft Vent Hose McDonald's	1	Vents excess pressure outdoors
--	20596400	Kit 15 ft Vent Hose McDonald's	1	Vents excess pressure outdoors
--	20596401	Kit 25 ft Vent Hose McDonald's	1	Vents excess pressure outdoors
--	20596402	Kit 50 ft Vent Hose McDonald's	1	Vents excess pressure outdoors
--	10802912	CO_2 Fill Hose Only, 5 ft	1	Transfers liquid CO_2 from fill box into tank
--	10802947	CO_2 Fill Hose Only, 15 ft	1	Transfers liquid CO_2 from fill box into tank
--	10802939	CO_2 Fill Hose Only, 25 ft	1	Transfers liquid CO_2 from fill box into tank
--	10370710	CO_2 Fill Hose Only, 30 ft	1	Transfers liquid CO_2 from fill box into tank
--	10370728	CO_2 Fill Hose Only, 50 ft	1	Transfers liquid CO_2 from fill box into tank
--	20604733	Cabinet Outdoor Beverage Tank	1	Ventilated, lockable, tank cover for outside installations
--	20609851	Kit Outdoor Vent Line Assembly	1	Routes tank vent discharge toward the ground on tanks installed outside
--	20609853	Kit Outdoor Fill Connection	1	Tank fill connection for tanks installed outside (not in enclosed areas)

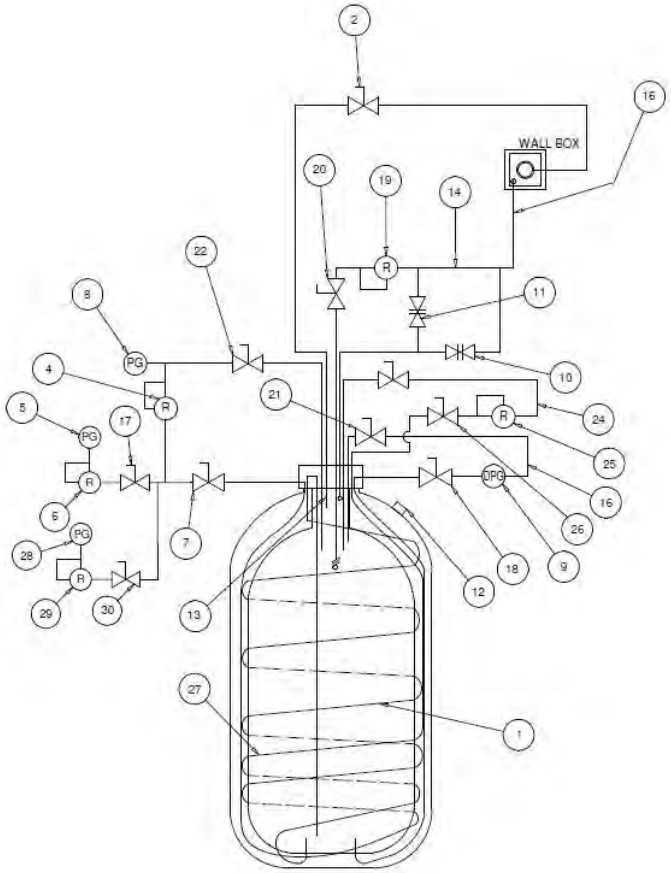
System Flow Schematics

McDonald's Carbo-Max 450 & 750



Item	Nomenclature
1	Vaporizer Coil - 3/8" OD SS Tubing
2	Liquid Fill Check Valve - 3/8" NPT
3	Tee Brass 1/2 FPT Forged
4	Economizer Regulator - 1/4" NPT set at 150 psig
5	Gas Use Pressure Gauge 0-160 psig
6	Gas Use Pressure Gauge 0-100 psig
7	Final Line Regulator - 1/4" NPT, Gas, set at 110 psig
8	Final Line Regulator - 1/4" NPT, Syrup, set at 65 psig
9	Gas Supply Isolation Valve (On/Off) - 1/4" NPT
10	Storage Tank Pressure Gauge 0-400 psig
11	Differential Pressure Gauge
12	Primary Pressure Relief Valve set at 300 psig ASME
13	Secondary Pressure Relief Valve set at 450 psig
14	Outer Vessel Pressure Protection set at 23 psig
15	Venturi Fill Device
16	Vent Line 1/2" OD Copper Tubing
17	CO_2 Fill Connection
18	Vent Line to Fill Box
19	CO_2 Use Connection Isolation Valve 1/4" NPT
20	High Side Differential Pressure Isolation Valve 1/4" NPT
21	Sure-Fill™ (automatic vent) Regulator - 1/4" NPT set at 200 psig
22	Sure-Fill Isolation Valve - 1/4" NPT
23	Low Side Differential Pressure Isolation Valve 1/4" NPT
24	Economizer Isolation Valve 1/4" NPT

McDonald's Carbo-Max 1000



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Item	*Description*	*Item*	*Description*
1	Vaporizer Coil 3/8" OD SS Tubing	16	Vent Line to Fill Box
2	Liquid Fill Valve 3/8" NPT	17	CO_2 Use Connection Isolation Valve 1/4" NPT (red handled)
3	Tee Brass 1/2 FPT Forged	18	High Side Differential Pressure Isolation Valve 1/4" NPT
4	Economizer Regulator 1/4" NPT, set at 150 psig	19	Sure-Fill™ (Auto Vent) Regulator 1/4" NPT set at 200 psig
5	Gas Use Pressure Gauge 0-160 psig	20	Sure-Fill Isolation Valve 1/4" NPT
6	Final Line Regulator 1/4" NPT set at 110 psig	21	Low Side Differential Pressure Isolation Valve 1/4" NPT
7	Gas Supply Isolation Valve (On/Off) 1/4" NPT	22	Economizer Isolation Valve 1/4" NPT
8	Storage Tank Pressure Gauge 0-400 psig	23	Emergency Shut-Off Label
9	Differential Pressure Gauge	24	Pressure Building Circuit
10	Primary Pressure Relief Valve set at 300 psig ASME	25	Pressure Building Regulator 1/4" NPT set at 125 psig
11	Secondary Pressure Relief Valve set at 450 psig	26	Pressure Building Isolation Valve (On/Off) 1/4" NPT
12	Outer Vessel Pressure Protection set at 23 psig	27	Pressure Building Coil 3/8" OD SS Tubing
13	Venturi Fill Device	28	Syrup Connection Pressure Gauge 0-160 psig
14	Vent Line 5/8" OD Copper Tubing	29	Syrup Connection Isolation Valve 1/4" NPT set at 65 psig
15	CO_2 Fill Connection	30	Syrup Connection Isolation Valve 1/4" NPT (red handled)

Service and Parts

Service or maintenance work on the Carbo-Max CO_2 storage system should be performed only by Chart trained and authorized professional service agents. These service agents are familiar with CO_2, bulk liquid CO_2 pressure tanks, 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 tank
- Description of the problem
- Readings from:
  - the contents gauge
  - the tank 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 Carbo-Max CO_2 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 tank 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.

Important Contact Information

The table below is provided for your benefit to record contact information related to your system.

Type of Contact	Contact Name	Contact Phone
CO_2 Supplier		
CO_2 Service Agent		
CO_2 Equipment Installer		

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 CO_2 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. 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 (four hours @ 65.00/hour maximum).

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, CO_2 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 tank 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.