BEEFY BACKPACK

ASSEMBLY, USE, AND TECHNICAL INFORMATION

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Beefy Backpacks

Instruction Manual

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Introduction:

This manual provides instruction on how to assemble and operate the "Beefy" Backpack Tree Marking Paint System. This backpack paint system offers an alternative to the manual tree-marking gun. Unlike manual tree marking guns that rely on the operator to pump and propel the paint, this backpack paint system uses compressed gas to propel tree-marking paint to the trees. Manual tree marking guns requires a significantly higher trigger pull force. The marker using the "Beefy" Backpack opens and closes a valve. The compressed gas does all the work.

There are several redundant safety devices built into the system to assure operator safety. A total of three relief valves and one burst disk were incorporated in the design to prevent over pressuring the system. The pressure in the steel tank is regulated down to 50-psi well below the 130 psi rated working pressure of the tank. However, practical care must be taken when operating this system. Information on safely handling the CO_2 cylinders is provided in this manual.

There are several backpack paint systems available; this paint system was designed to operate at a higher pressure and be more durable.

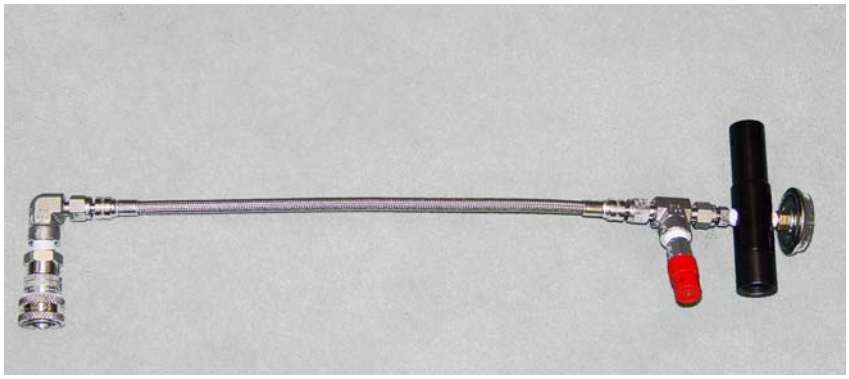
Assembling Beefy Backpack Components

1. Backpack and harness.

2. Steel tank.

3. Spray wand assembly.

4. Gas supply line assembly.

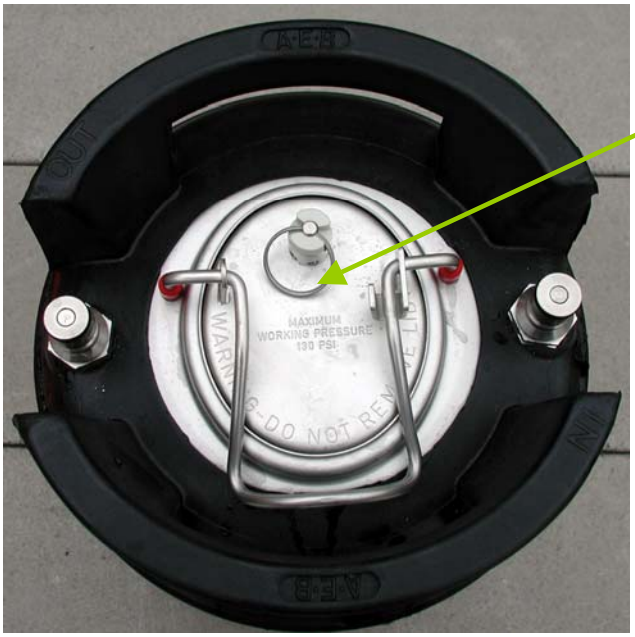


Note: Due to shipping regulations, CO_2 bottles were not included in the kit. CO_2 bottles can commonly be purchased where sporting goods or paint gun supplies are sold. CO_2 bottles may be refilled at sporting goods stores, paint gun supply stores, medical gas suppliers, and welding suppliers.

Assembling the Beefy Backpack

1. Fill the metal tank with the desired amount of paint.
   Note: It is recommended that you use water for your initial setup. Use paint when you are familiar with the system.

   a. Release pressure in the steel tank by pulling on the key ring. If the tank is pressurized air will rush out of the valve immediately below the key ring. Once the air stops flowing out of the valve, the pressure is relieved and the lid can be removed.



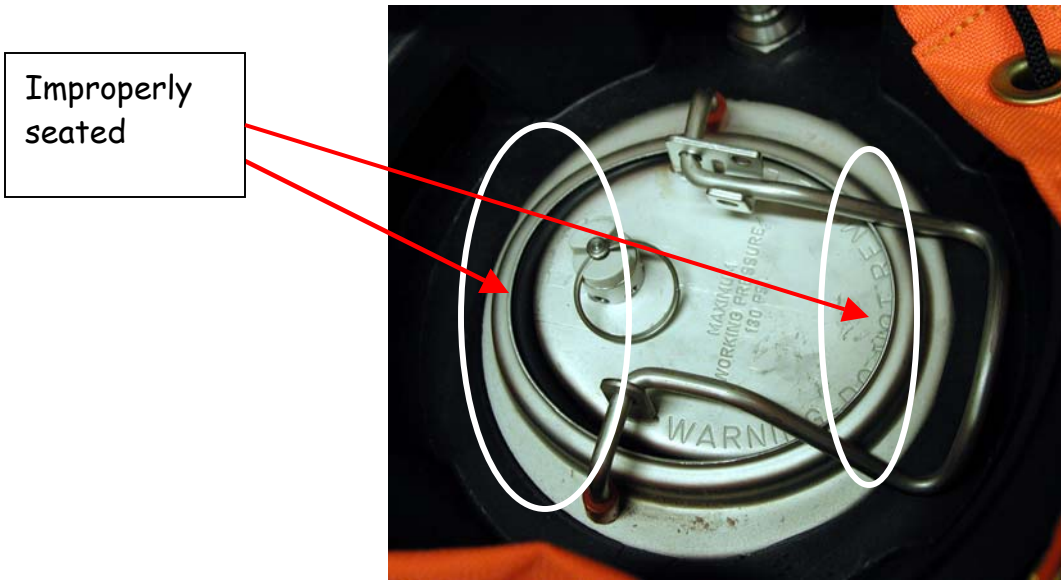
Pull on key ring to release pressure

   b. Lift latch and push down on the lid.

c. Remove the lid from the tank.

d. Fill tank with the desired amount of paint.

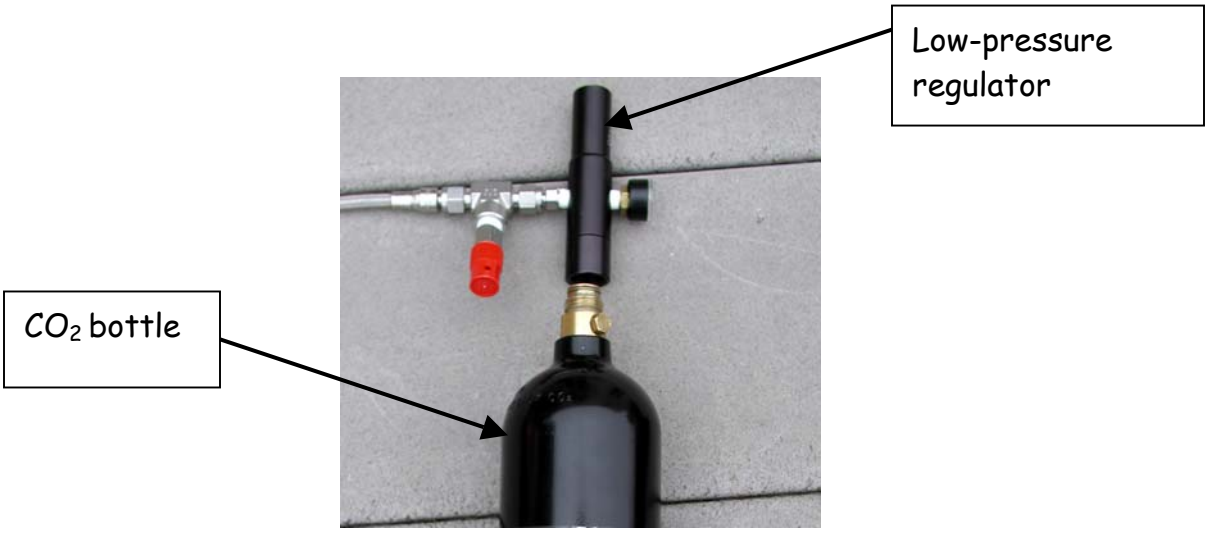
e. Replace the lid. Verify that the lid is properly seated.



2. Place the metal tank inside the backpack.

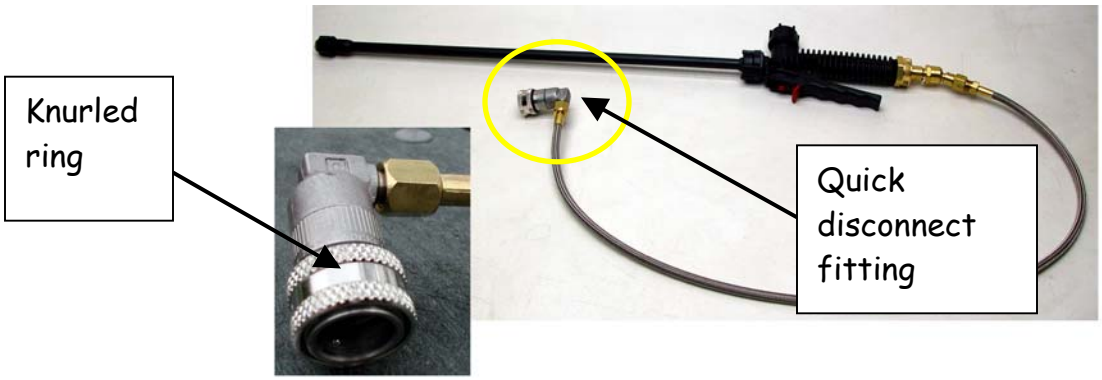
3. Insert the plastic wand into the plastic handle. Tighten the wand nut.

4. Screw in the CO_2 bottle to the low-pressure regulator until snug.

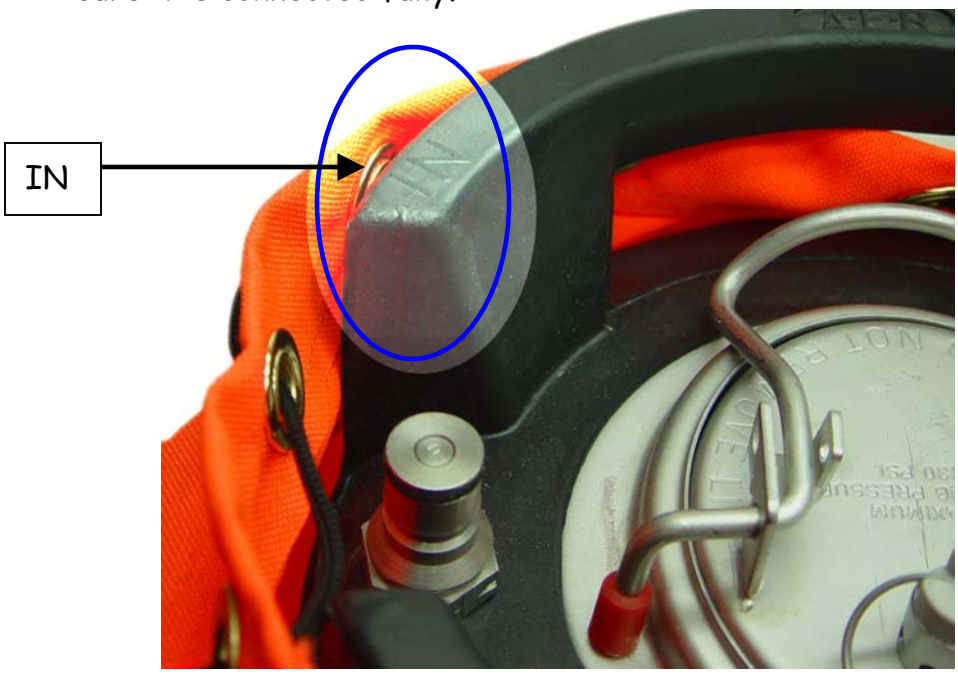


5. Check the pressure reading on the pressure gage. The gage should read 50, ± 5 psi. All regulators were preset at SDTDC. Minor adjustments may be needed, due to differences in atmospheric pressure. If the pressure needs to be adjusted, REMOVE the CO_2 bottle, then use a 3/16 Allen (hex) wrench to increase or decrease the pressure located on the side of the regulator. Attach the CO_2 bottle and re-check the gauge. Repeat this process until the desired pressure is reached.

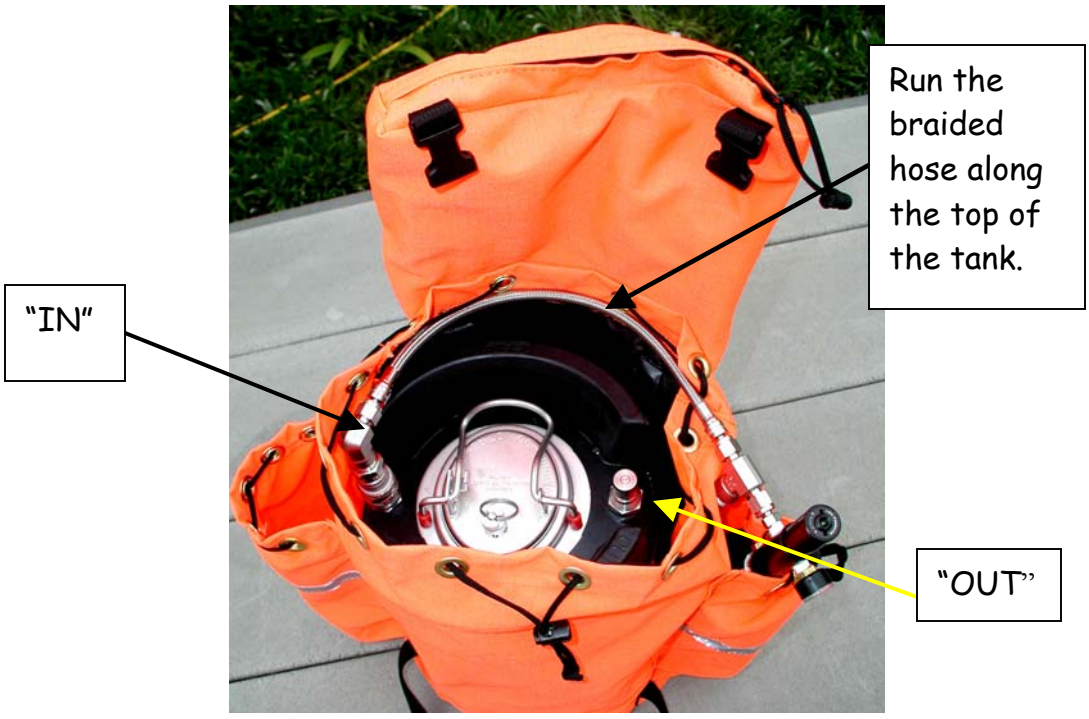
6. The gas supply line and spray wand assembly have quick disconnects. There operation is similar to quick connects on air compressors and hydraulic lines.
    - Connecting
        a. Pull the knurled ring back.
        b. Push the quick disconnect fitting towards the tank.
    - Disconnecting
        c. Pull the knurled ring back.
        d. Pull the quick disconnect fitting away from the tank.



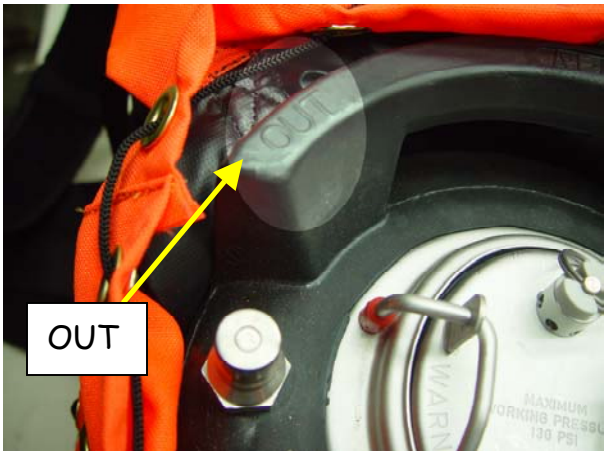
7. Connect the gas supply line to the side marked "IN" of the metal tank.
   - If the system is leaking air, try to tighten up the CO_2 bottle, check the tank lid for a proper seal, and inspect the quick disconnect to be sure it is connected fully.



8. Place the CO_2 bottle on the opposite pocket of the side marked "IN". Position the braided hose as shown in the figure below.



8. Connect the spray wand assembly to the side marked "OUT". Follow steps 5a and 5b above. Run the braided hose to the opposite side.

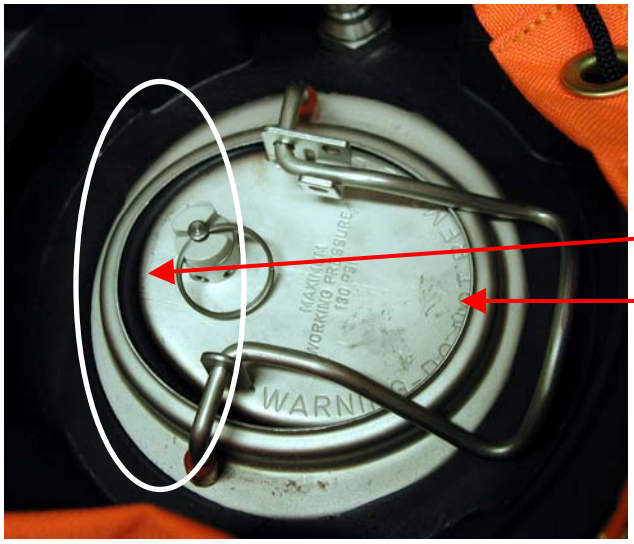


9. Pull the drawstrings around the main compartment and side pockets and secure flap cover. Snap "D-ring" strap to the harness.

Refilling Tank with Paint

1. Disconnect gas supply line from the steel tank.
2. Pull on the keyring to relieve the pressure in the tank (See Page 6, Step 1a).
3. Remove the tank lid. (See Page 6, Steps 1b and 1c).
4. Fill the tank with the desired amount of paint.
   Note: Filling the tank 7/8 to ¾ full will help to extend the use of the CO_2.
5. Replace tank lid. Inspect lid for proper seal.

Lid is proper seated.



Lid is improperly seated.

6. Reconnect the gas supply line.

Operating the Beefy Backpack

1. Make sure there are no gas leaks in the lines or fittings. If gas leaks are present try to determine where the leaks are coming from. Make the necessary adjustments to correct the problem.

2. Squeeze the handle on the wand to get the desired amount of paint.

3. Release the handle to stop.

Disassembling and Cleaning the Beefy Backpack

1. Disconnect gas line assembly.

2. Unscrew CO_2 bottle from the low-pressure regulator.

3. Disconnect the spray wand assembly.

4. Release pressure on the steel tank by pulling on the key ring.

5. Remove lid.

6. Pour the excess paint back into their containers rinse the tank with a standard paint cleaning solution.

7. The steel tank containing cleaning solution may be repressurized.

8. Run the cleaning solution through the system to rinse out all of the paint in the lines and in the wand.

Additional Information

Figure 1: "Beefy" Backpack Tree Marking System

Backpack Components:

This tree marking paint system is made up of four major components:

- Backpack
- Steel tank
- Compressed gas cylinder and supply line assembly
- Spray wand

Backpack

The backpack is a modified fire field pack. The backpack carries the tank, gas cylinder, and some personal items. The main compartment of the backpack is deeper to fit the steel tank. The tree marker can attach

canteen cases or pouches to the backpack harness. Other backpacks and harnesses may also be used.

Figure 2: Complete backpack

Figure 3: Other harnesses can be used

Steel tank

The steel tank is a 2.5 gallon stainless steel beverage tank. The tank has a rated working pressure of 130 psi and is equipped with a relief valve that opens at 100 psi. The relief valve releases the pressure in the tank when it exceeds 100 psi and closes when the pressure in the tank falls below 100 psi. This is a safety device and should not be modified. This relief valve should be cleaned and inspected after each use.

The tank is also equipped with an "IN" and "OUT" quick disconnect valves. These valves are labeled accordingly. The gas goes into the steel tank from the gas cylinder through the "IN" valve. Paint leaves the steel tank through the "OUT" valve. Although the valves look similar, they are not interchangeable.

Steel Tank Specifications	
Volume	2.5 gallons
Working pressure	130 psi
Relief valve cracking pressure	100 psi
Empty Weight	6 lbs
Full Weight	28 lbs

Figure 4: Stainless steel beverage tank

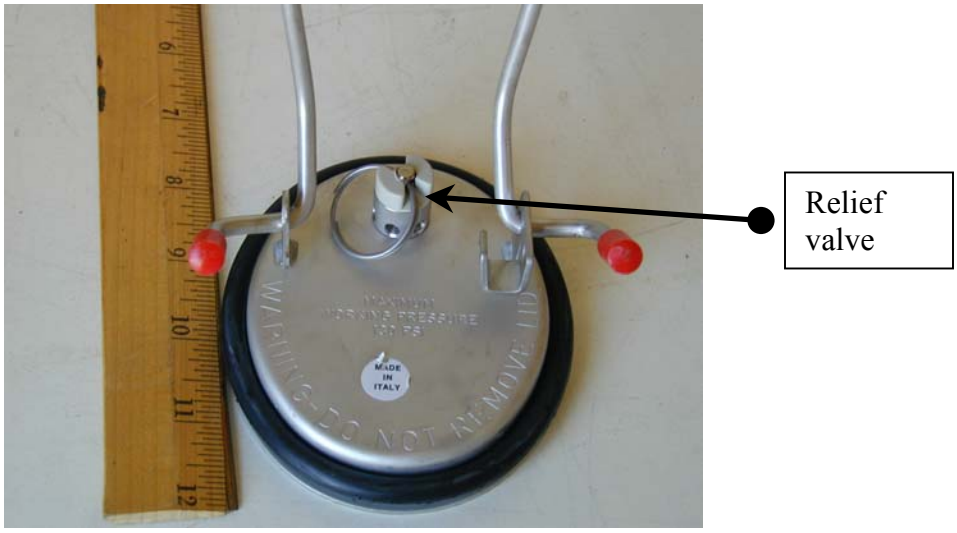


Figure 5: Tank lid and relief valve

Compressed Gas Cylinder (Bottles)

This tree marking system uses CO_2, although compressed air will also work. CO_2 is preferred because it provides a more consistent pressure. The CO_2 cylinders are the same bottles used in paintball guns. There are three common bottle sizes: 8 oz, 12 oz, and 20 oz. The backpack paint system will accommodate any of the three sizes. These bottles are rated for 1800 psi. The cylinder is filled by weight and not by volume. Only 68 percent of the volume of the bottle will be occupied by liquid carbon dioxide when the cylinder is full. DO NOT OVERFILL THE CYLINDERS. Only qualified personnel should fill these cylinders. Technical support documents, provided by the cylinder manufacturer, are included in the appendix. These documents provide information on the handling, storage and maintenance of these cylinders. Information on the dangers of overfilling the cylinders is also found in the appendix.

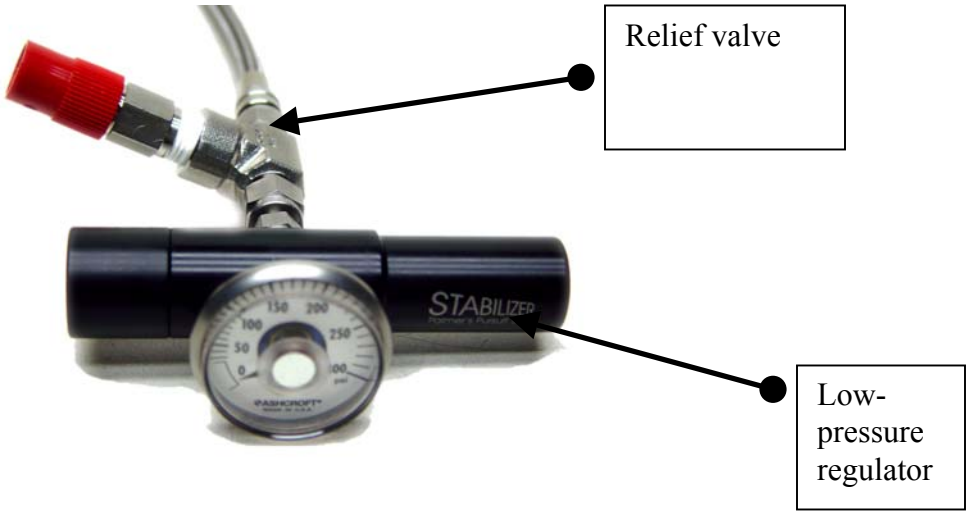
The cylinder is also equipped with a "burst disk". The "burst disk" is a pressure relief device that is factory installed and should not be replaced or tampered with. The "burst disk" is a one-time use safety device; once the burst disk has ruptured, pressure in the bottle is released. Before the "burst disk" will be activated, three other relief valves have to fail.

The cylinders can be filled at welding supply stores or bottles can be bought from sporting goods stores and paintball supply stores.

Figure 6: Carbon dioxide bottles

Low Pressure Regulator:

The low-pressure regulator reduces the pressure in the CO_2 bottle down to 50 psi. The pressure gage reads the regulated pressure and should indicate 50 psi. A self-resetting relief valve, built into the regulator, opens at 300 psi. Another relief valve after the regulator is also installed in this system. This relief valve will release the pressure in the event the regulator fails. This relief valve will open at 60 psi.



Spray Wand Assembly

The spray wand is an agricultural sprayer typically used in spraying pesticides. A wand is used instead of a gun to reduce the marker's exposure to "spray back". Spray back simply means paint splattering back as it is deflected from the tree. This is common in all sprayers including manual paint guns. The wand increases the distance between the tree and the marker and thus making it more difficult for paint to "splatter" back to the marker.

There are several nozzles available for this paint system. Brass, flat stream nozzles work the best. Nozzles like the TeeJet Flat Stream nozzles are suggested.

The wand is attached to the steel tank via a braided steel hose. This was selected for its durability. The braided steel hose terminates with a brass swivel hose fitting. The swiveled hose fitting prevents the hose from twisting and unscrewing the hose fitting from the wand.

Replacement parts:

Wand Assembly – Solo USA sells the wand components. These parts are sold separately. These parts are also available through Sprayer Outlet.

Wand – part # 4900230
Nozzle - part # 0065210
Cap - part # 4074148
Handle (Shut- off Valve) - part # 4800170

Solo, Inc
5100 Chestnut Avenue
Newport News, VA 23605
757-245-5531
www.solousa.com

Sprayer Outlet
21 Oak Knoll Drive
Hillsville, VA 24343
800-251-8824
www.sprayer-outlet.com/solo.htm

Regulator – The manufacturer can set the regulated pressure down to 50 psi at your request.

Female Stabilizer - Low Pressure Regulator set @ 60 psi
0 -300 psi Ashcroft gage

Palmer Pursuit Shop
3951 Development Drive Suite 3
Sacramento, CA 95838

Compress Gas lines and fittings – These fittings are also available through any Swagelok distributor.

Flex Hose - SS-4BHT-12
Tube Adapter - SS-4-TA-1-2
Deflector Cap - P-4CP4-K12-RD
Female Branch Tee - SS-400-3-4TTF

Female Elbow - SS-400-8-4,
Adjustable Check Valve - SS-4CPA2-50,

Orange Fluid Systems Technologies
1630 s. Sunkist Street, Suite E
Anaheim, CA 92806
Phone: 714-634-0216, Fax: 714-634-4816

Steel Beverage Tanks

2.5 Gallon Beverage Tank P/N 1028zs

Manitowoc Beverage Systems

Hose for wand

Beefy Backpack Kit. This part name was created for the set of fittings and hose for the Beefy Backpack Paint System

Alternative Hose Inc.
1291 Sunshine Way #B
Anaheim, CA 92806
(714) 414-0904

Backpack and Harness Options

Beefy Backpack

What-On Earth
#104, 11504-170 St. NW
Edmonton, Alberta, Canada TSS 1J7
780-455-5757

Harness

What-On Earth
#104, 11504-170 St. NW
Edmonton, Alberta, Canada TSS 1J7
780-455-5757

Ruffian Specialties
1247 S. Buena Vista, Unit J
San Jacinto, CA 92583
(909) 487-0909

Technical Support Documents

Dangers of Overfilling CO_2 Paintball Cylinders

August 1, 2000

Overfilling a CO_2 cylinder, be it an attempt to get longer service out of one charge of a cylinder or be it accidental, can have unexpected and even catastrophic consequences due to the expansion characteristics of the CO_2 charge.

We at Catalina Cylinders have heard many times that it is not fair that a CO_2 cylinder is deemed full at only 68% of its water capacity, that there appears to be 32% of its water capacity that is not being used, or wasted, and that this capacity not being used could be used for extended service life of one CO_2 charge. This 32% is not spare, or wasted, capacity. Following are three situations that identify why this 32% of the total water capacity of a CO_2 cylinder is not spare, or wasted, capacity.

1. A 20-ounce CO_2 paintball cylinder with a full charge (68% of its water capacity)
   When a fully charged, 68% full by water capacity, 20-ounce CO_2 cylinder warms up to room temperature (70 °F), the pressure inside the cylinder is 837 psi. When the cylinder reaches 87.9 °F the entire charge becomes a gas no matter what the pressure. A fully charged CO_2 cylinder at 87.9 °F will have an internal pressure of approximately 1100 psi. At 120 °F a fully charged CO_2 cylinder will have an internal pressure of nearly 2000 psi, this is greater than the designed service pressure of 1800 psi of the cylinder. Remember that this cylinder at 120 °F has an internal pressure greater than the marked service pressure of the cylinder and is properly filled, not overfilled. Also note that 120 °F is not an excess temperature and can quite easily be reached in many different environments (i.e. in a shed or a vehicle on a hot day or in a kitchen).

2. A 20-ounce CO_2 paintball cylinder with a 5-ounce overfill (85% of its water capacity)
   The following would occur if a 20-ounce CO_2 cylinder were slightly overfilled with 25 ounces of CO_2 charge to increase its service life between fills. When the cylinder and charge warm to room temperature the internal pressure of the cylinder would be 1430 psi. If the cylinder were warmed to 103 °F the cylinder would vent through the safety device of the valve. This venting would most likely be unexpected since it would not be known when the cylinder would warm to 103 °F. Unexpected venting through the safety device of a valve has caused property damage and personal injury.

3. A 20-ounce CO_2 paintball cylinder greatly overfilled (95% of its water capacity) A 20-ounce CO_2 cylinder filled to 95% of it's capacity, not quite liquid full would vent through its safety prior to the cylinder reaching room temperature, 70 °F. If the safety disc has been altered and reinforced and would not actuate, the cylinder would rupture between 85 ° - 95 °F. Rupturing cylinders have caused severe property damage and serious personal injury, even loss of life.

Accidental overfilling or overfilling due to inaccurate equipment (i.e. the scale being used in the filling process not being calibrated or not being able to measure in small enough units of measure to accurately fill small cylinders) will have the same results as purposely overfilling

a cylinder. The affects of accidental overfilling of a small CO_2 cylinder can have catastrophic affects as described below.

A 7-ounce CO_2 paintball cylinder filled accidentally with 2.8 extra ounces of CO_2 will be filled to 95% of its capacity. As stated above, a cylinder filled to 95% of its water capacity would vent through its safety device before the cylinder warms to room temperature.

In summary, never overfill a CO_2 cylinder, on purpose or accidentally. The affects of overfilling coupled with the affects of increasing temperature on the CO_2 charge, will greatly increase the probability that something catastrophic could happen to property or personnel. Do not take the risk, do not overfill a CO_2 cylinder.

Technical Support Document
Handling of CO_2 Cylinders

July 31, 2000

Catalina Cylinders recommends that anyone handling CO_2 cylinders should be aware of the hazards associated with CO_2 and be trained in safe practices of handling CO_2 cylinders. All practices of handling CO_2 cylinders ought to include or reference information from CGA pamphlets G-6; Carbon Dioxide and G-6.3; Carbon Dioxide Cylinder Filling and Handling Procedures.

Catalina Cylinders has compiled the following list of items that should be included in any safe handling practice of CO_2 cylinders.

1. Only trained personnel should handle CO_2 cylinders. Trained personnel should be aware of the hazards associated with CO_2. CO_2 discharged from a cylinder is extremely cold and can cause injury if it comes into contact with personnel.

2. CO_2 cylinders should only be handled with care. Never drag or drop cylinders.

3. Never attempt to handle a leaking CO_2 cylinder.

4. CO_2 cylinder should never be handled in areas of extreme heat (125 °F or greater).

5. The valve should always be closed when handling a cylinder.

6. If a cylinder is fitted with a valve cap, always verify the cap is secure before handling.

7. If a cylinder is fitted with a carrying handle, always verify the carrying handle is secure and not broken before handling. Never handle a cylinder by a broken carrying handle.

8. Be aware that cylinders that have been in service may have sharp edges from previous rough handling. Visually inspect the cylinder for sharp edges prior to handling the cylinder with your hands.

9. When lifting a cylinder, use proper lifting techniques.

10. When handling a cylinder with equipment, make sure the equipment does not scar or damage the cylinder or valve.

11. When using a cart to handle cylinders, always secure the cylinder to the cart.

12. After handling a cylinder, always transport and/or store the cylinder in accordance with good safe transporting and/or storing practices.

Including the above items in all practices for handling CO_2 cylinders should enhance the safety of all personnel, equipment and property.

Technical Support Document
Storing of CO_2 Cylinders
April 4, 2000

Catalina Cylinders recommends that anyone storing CO_2 cylinders should be aware of the hazards associated with CO_2 and be trained in safe practices of storing CO_2 cylinders. All practices of storing CO_2 cylinders ought to include or reference information from CGA pamphlets G-6; Carbon Dioxide and G-6.3; Carbon Dioxide Cylinder Filling and Handling Procedures. Catalina Cylinders has compiled the following list of items that should be included in any safe storage practice of CO_2 cylinders.

1. CO_2 cylinders should always be stored in a specified area. The storage area should:
    - Be well ventilated. CO_2 gas in small concentrations, as little as 15%, can cause unconsciousness in less than one minute.
    - Be selected away from the edge of $_{any}$ elevated areas. Cylinders falling from elevated areas can cause damage to the cylinder, valve or property or injury to personnel.
    - Be selected away from, or protected from, areas of high traffic. Areas of high traffic only increase the chance of an accident occurring.
    - Be dry and free of a corrosive atmosphere.
    - Have adequate means to secure all cylinders stored in the area. The means of securing should be sufficient to hold the cylinders in place, yet not cause damage to the cylinders.
    - Be a continuously cool place. Do not store cylinders adjacent to any source of heat, intermittent or continuous. Safety relief devices of CO_2 cylinders are designed to operate when the pressure of the cylinder exceeds 2800 - 3000 psi (depending on the design of the safety relief device). A properly charged CO_2 cylinder could vent through its safety relief device at approximately 150 °F (65.6 °C). A slightly overfilled CO_2 cylinder could vent through its safety relief device when exposed to a much lower temperature. The CGA recommends that CO_2 cylinders be stored in areas with a temperature less than 125 °F (51.7 °C).
2. Never store a charged CO_2 cylinder in a passenger vehicle or in the cab portion of any vehicle.
3. Empty CO_2 cylinders should be stored with the valve tightly closed.
4. Cylinders can be stored standing on their base or lying on their side. Catalina Cylinders recommends that the cylinders be stored as designed, standing on their flat base.

5. Cylinders should not be stored where they might become part of an electrical circuit.

6. Cylinders, which have been manufactured to accommodate a valve protective carrying handle or a protective cap, should be stored with these accessories in place.

Including the above items in all practices for storing CO_2 cylinders should enhance the safety of all personnel, equipment and property.