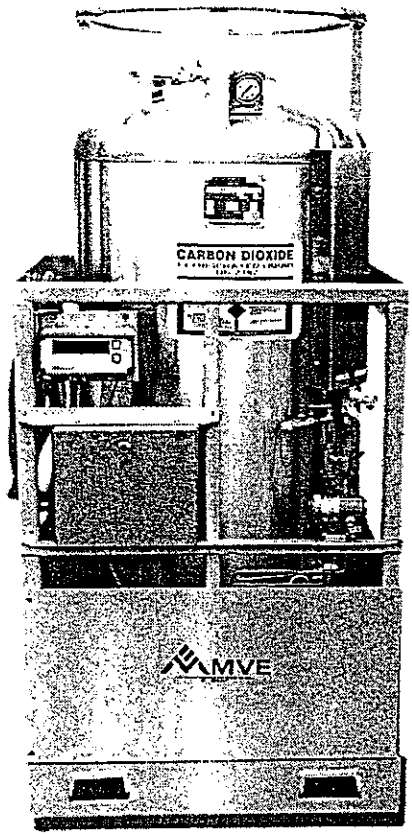
User's Manual



VLCD-1300

MVE

1. Table of Contents

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2. Warranty Information

2.1. Terms and Scope of Warranty

MVE, Inc. (MVE) warrants the VLCD-1300 bulk CO_2 system equipment for one (1) year from MVE invoice date, that said equipment shall be free from any defects in workmanship and materials. MVE will also maintain the vacuum and ensure the reliability of the VLCD-1300 system for five (5) years from MVE invoice date.

2.2. Conditions of Warranty

Purchaser agrees that as a pre-condition to any MVE liability thereunder, Purchaser or its appointed agents shall fully inspect all goods immediately upon delivery and shall give MVE written notice of any claim or purported defect within ten (10) days after discovery of such defect. As a further pre-condition to any MVE liability thereunder, both part replacement and labor must be supplied by an approved MVE service company. MVE may elect to repair or replace such equipment or any defective component or part thereof which proves to be defective, or to refund the purchase price paid by the original Purchaser. Alterations or repair by others or operation of such equipment in a manner inconsistent with MVE accepted practices and all operating instructions, unless pre-authorized in writing by MVE, shall void this Warranty. MVE shall not be liable for defects caused by the effects of normal wear and tear, erosion, corrosion, fire, explosion, misuse, or unauthorized modification.

2.3. Limitation of Liability

MVE's sole and exclusive liability under this Warranty is to the Purchaser and shall not exceed the lesser of the cost of repair, cost of replacement, or refund of the net purchase price paid by the original Purchaser. MVE is not liable for any losses, damages, or costs of delays, including incidental or consequential damages. MVE specifically makes no warranties or guarantees, expressed or implied, including the warranties of merchantability or fitness for a particular purpose or use, other than those warranties expressed herein.

2.4. Warranty Claims Procedure

All warranty claims must be previously authorized by:

MVE, Inc.

Telephone, electronic or written approval may be obtained by contacting MVE's Technical Service Department at:

MVE, Inc.
3505 County Road 42 West
Burnsville, MN 55306-3803
Telephone: 800-253-1769
Facsimile: 612-882-5172

Authorization must be obtained from MVE prior to shipment of any equipment to our facilities. The purchaser must provide the serial number of any or all tanks to be repaired or returned to MVE. Once approved a return management and authorization (RMA) number will be provided to the purchaser. The RMA number must be included in the packing slip of any or all equipment to be shipped to MVE.

3. Safety Information

3.1. Important Safety Precautions

- THIS TANK HOLDS AND DISPENSES CARBON DIOXIDE (CO_2) WHICH DISPLACES OXYGEN AND CAN CAUSE ILLNESS OR DEATH.
- CARBON DIOXIDE GAS IS DIFFICULT TO DETECT
- AS A RESULT THIS TANK MUST BE VENTED OUTDOORS.
- DO NOT MAKE CONTACT WITH CARBON DIOXIDE IN ANY FORM (GAS, LIQUID OR SOLID).
- SINCE CARBON DIOXIDE IS HEAVIER THAN AIR IT CAN COLLECT IN LOW OR CONFINED SPACES SUCH AS BASEMENTS, STAIRWELLS OR STOREROOMS

3.2. Qualities of CO_2 Gas

- COLORLESS
- SLIGHTLY PUNGENT ODOR
- HEAVIER THAN AIR

3.3. Physiological Effects of CO_2

- DIZZINESS, HEADACHE OR NAUSEA
- LOSS OF BREATH
- SUFFOCATION
- UNCONSCIOUSNESS
- DEATH (POSSIBLE IF EXPOSED TO CONCENTRATIONS OF 10% OR MORE)

3.4. First Aid Procedures

3.4.1. Inhalation of CO_2 Gas

- REMOVE TO FRESH AIR IMMEDIATELY
- GIVE ARTIFICIAL RESPIRATION IF NOT BREATHING
- GIVE OXYGEN IF HAVING DIFFICULTY BREATHING
- CALL PHYSICIAN OR PARAMEDICS FOR HELP

3.4.2. Contact With Dry Ice

- STOP EXPOSURE AT ONCE
- DO NOT POUR WATER ON WOUND
- OBTAIN IMMEDIATE MEDICAL ATTENTION

3.5. Spill or Leak Procedures

- EVACUATE ALL PERSONNEL FROM AFFECTED AREAS
- VENTILATE AFFECTED AREAS THOUROUGHLY BEFORE RE-ENTERING
- VENTILATE ANY BASEMENT AREAS OR STAIRWELLS WHICH MAY HAVE COLLECTED CARBON DIOXIDE

3.6. Filling Precautions

- ALWAYS WEAR GLOVES AND PROTECTIVE EYEWEAR WHEN MAKING LIQUID CO_2 TRANSFERS
- AFTER FILLING STORE TANK CLOSE THE LIQUID FILL VALVE AND OPEN THE LINE DRAIN VALVE (ITEM 18)
- REMOVE THE FILL CONNECTION VALVE SLOWLY TO RELIEVE PRESSURE SLOWLY FROM LINE

4. Introduction

4.1. System Objective

The VLCD-1300 liquid carbon dioxide storage and metering system is designed to provide a safe, reliable and economic method for the transport and distribution of bulk carbon dioxide. The tank is primarily intended to fulfill the delivery requirements of medium-sized mini bulk distributors. Since the VLCD-1300 is larger than liquid cylinders there is no need to jumper tanks or force a transfer with high pressure cylinders. On the other hand the tank is small enough for medium-sized distributors to afford. The optional flow meter and printer allow the distributor to accurately monitor the amount of product delivered and to print out the quantity on a wide variety of ticket forms.

4.2. System Overview

Engineered as a complete delivery system the VLCD-1300 includes a vertical stainless steel vacuum jacketed 1300 pound storage tank, a rugged carbon steel skid and an optional flow meter and ticket printer. The flow meter and printer are powered with a retractable 12 volt cord which adapts to any standard cigarette lighter. Liquid CO_2 is delivered through a 35 foot flex hose and ¾ inch quick connector. A hose reel, which attaches to the outside of the skid, may be purchased as an option. The flow meter, which is a differential pressure orifice meter, is very accurate and long lasting. A ticket printer located in a durable stainless steel housing is also available.

5. General Description

5.1. Storage Tank

Standing over six feet tall and nearly three feet in diameter the tank can hold up to 1300 pounds of liquid CO_2. The large capacity allows several store tanks to be filled without making unnecessary return trips to the mother tank. The tank also features a minimal evaporation rate of 6.5 pounds per day due to MVE's super insulation technology. Liquid delivery is made efficient by the tank's pressure building system. As liquid CO_2 is delivered to the store tank the pressure builder quickly restores the tank to its design working pressure of 300 psi. The sturdy bull ring on top of the tank prevents the plumbing components from being damaged.

5.2. Plumbing Components

The plumbing components on the tank carry out four functions:

- Liquid Fill
- Liquid Delivery
- Pressure Maintenance
- Pressure Relief

Each function of the tank is carried out by its own circuit except for pressure relief. First, the fill circuit allows liquid CO_2 to be dispensed from the mother tank into the VLCD-1300. Second, the liquid delivery circuit dispenses the product from the VLCD into a mini bulk tank. Third, the pressure building circuit converts liquid CO_2 to a gas to maintain pressure within the tank. Finally, the pressure relief circuits allow the tank to be vented manually or automatically. Excess pressure in the tank may be relieved by the Safety Pressure Relief Circuit, the Auxiliary Pressure Relief Circuit or the Manual Vent Line.

5.2.1. Pressure Building Circuit

The pressure building circuit withdraws liquid CO_2 from the bottom of the inner vessel, takes in heat from the outer shell and delivers the CO_2 in the form of a gas to the head space. It consists of a pressure building coil controlled by two isolation valves and a pressure building regulator.

5.2.1.1. Pressure Building Coil

The P.B. coil winds around the base of the inside surface of the outer shell approximately two times before it travels vertically to the head space. The coil is made of 3/8" OD stainless steel tubing and is nearly twenty feet long altogether.

5.2.1.2. P.B. Regulator

The pressure building regulator, item 6, is factory set at 300 psi and should not be adjusted. It is designed to maintain the tank pressure at 300 psi and has ¼" FPT ports.

5.2.1.3. P.B. Isolation Valves

The P.B. isolation valves, items 9a and 9b, are ¼" FPT brass ball valves. The are intended to isolate the P.B. regulator should it need to be replaced or serviced. Make sure the handles of both valves are in line with the circuit while operating the tank.

5.2.2. Safety Pressure Relief Circuit

Since the tank is an ASME Section VIII, Division 1 coded vessel it requires safety relief devices approved by ASME. The relief system includes an ASME 350 psi primary relief valve and a secondary relief device for additional safety.

5.2.2.1. ASME 350 psi Relief Valve

The primary relief valve is an ASME 350 psi relief valve approved for CO_2 service. Set at 350 psi the relief valve allows the tank to function without venting at normal operating pressures yet it is set low enough to maintain safe operation.

5.2.2.2. 450 psi Burst Disk

This device ruptures near 450 psi and safely vents all the pressure out of the tank should the pressure reach this point. The burst disk is a secondary relief device which backs up the primary relief valve should it fail to operate. It is provided to insure safe operation.

5.2.3. Auxiliary Pressure Relief Circuit

The auxiliary pressure relief circuit is intended to preserve the integrity of the primary relief valve by frequently venting excess pressure through a regulator rather than the primary relief valve itself.

5.2.3.1. Auxiliary Relief Valve

Set at 325 psi the auxiliary relief valve will vent excess pressure before the primary relief thereby conserving the primary relief's valve seals. Repeated venting degrades valve seals over time from the friction and vibration caused by leaking gas. By using the auxiliary relief one is able to maintain safe operating conditions and to save money. The auxiliary relief valve is more durable and less expensive than the primary relief valve itself.

5.2.3.2. Auxiliary Isolation Valve

The auxiliary isolation valve controls the operation of the auxiliary relief valve. Make sure the handle is in line with the circuit when operating the tank.

5.2.4. Manual Vent Circuit

The manual vent circuit allows the tank to be quickly vented or pressurized. For convenience the control valve and fitting on the circuit are located midway along the side of the tank.

5.2.4.1. Bronze Globe Valve

The bronze globe valve, item 40, has 3/8 NPT fittings and offers fine adjustment of flow rates.

5.2.4.2. Flared CO_2 Fitting

The 5/8" 45 degree flared fitting is standard for CO_2 service. Standard CO_2 fill hoses may be attached to it to make pressure transfers from or into the tank if necessary. It also includes a cap nut for protection.

5.2.5. Liquid Fill Line

The liquid fill and liquid delivery lines originate from a dip tube which starts at the bottom of the inner vessel. The line extends out through the knuckle and down along the side of the tank. Midway down the tank it branches to form the liquid fill and the liquid delivery lines. In short, the liquid fill line consists of a valve and a flared fitting which tie into the liquid delivery line

5.2.5.1. Isolation Valve

The isolation valve, item 17, is a ¾" brass ball valve which allows the fill process to be easily controlled. The valve is open when the handle is in line with the circuit

5.2.5.2. Flared CO_2 Fitting

The flared fitting for the fill line is the same as the vent fitting. It allows standard CO_2 5/8" 45 degree flared hose fittings to be connected to the tank for filling. A cap nut is included for protection.

5.2.6. Liquid Delivery Line

Extending from the dip tube described above the liquid delivery line exits the knuckle, traverses the entire length of the tank, continues through a 35 foot long flex hose and finally exits through a ¾" FPT quick connector. Each component in the line is described below.

5.2.6.1. Isolation Valve

The liquid delivery isolation valve, item 44, controls the delivery process. The valve has a ¾" body to minimize flow restriction. The valve is open when the handle is in line with the circuit.

5.2.6.2. Strainer

The bronze ¾" strainer, item 33, filters out particles which may be in the CO_2 supply. It also straightens the flow for accurate meter reading.

5.2.6.3. Metering Section

The welded ¾" metering section, item 51, has a restriction inside which creates a differential pressure in the flowing product. The differential pressure is then measured, converted to an electrical signal and then used to calculate flow rate and total quantity delivered by the flow processor.

5.2.6.4. Line Drain Valve

The line drain valve, item 18, is a 3/8" FPT globe valve. It is used to drain the line pressure after a delivery has been made.

5.2.6.5. Line Pressure Gauge

The line pressure gauge, item 20, displays the line pressure.

5.2.6.6. Line Pressure Relief Valve

The line pressure relief valve, item 19, relieves the line pressure if it reaches 450 psi. It is a safety device used to protect the fill hose from bursting. The delivery line needs to be vented after each use.

5.2.6.7. Fill Hose

The standard fill hose, item 27, is 35 feet long and has ½" MPT and ¾" MPT fittings on each end. It is a medium pressure hose suitable for use with liquid CO_2.

5.2.6.8. Quick Coupler

The ¾" FPT repairable quick coupler, item 34, connects the fill hose to the customer's fill station. It has a spring activated valve which opens when connected to the customer's fill nipple and closes completely when disengaged. The repair kit for the coupler is MVE part number 10848232.

5.3. Sight Gauge Assembly

The sight gauge assembly allows the user to monitor the quantity of liquid product in the tank. It has an external ring magnet which slides on a shaft as it reacts to the magnetic tip of the float rod inside.

5.3.1. O-Ring

The o-ring, which seals the gauge assembly to the tank, is approximately 1 inch in diameter and 3/32" thick.

5.3.2. Extension Spring

The extension spring, item 64, provides the necessary tension on the float rod to allow accurate readings.

5.3.3. Float Rod Assembly

The float rod assembly, item 65, includes the float rod welded to an extension rod and a magnet welded to the tip to form one unit.

5.3.4. Orange Ceramic Magnet

The orange ceramic magnet is ring shaped and traverses along the gauge tube to display the liquid level in the tank.

5.3.5. Clear Sight Gauge Protector

The sight gauge protector prevents the sight gauge from being damaged. Clear plastic represents CO_2 use

5.3.6. Knuckle Plug

The knuckle plug is the threaded portion which screws into the tank. It holds the sight gauge in place.

5.3.7. Magnetic Gauge Tube

The magnetic gauge tube provides a basis on which the ring magnet can traverse.

5.4. Skid

The carbon steel skid measures 38" by 38" by 54" tall. It is constructed primarily of 2" square tubing, 6" U-channel, and 3/8" plate. The skid provides a platform on which the tank may be easily transported. It also provides a structure to which the flow meter, printer, electric cord reel and delivery hose may be attached

5.5. Flow Meter

The VLCD-1300 employs a venturi-type flow meter which calculates the flow rate based on differential pressure. This type of flow meter works well with CO_2 because it is accurate within 1% error, has no moving parts and is therefore long lasting. System components include a flow processor, a differential pressure transmitter, a metering section and a ticket printer. An instruction manual for the flow meter is available from MVE.

5.5.1. Metering Section

The metering section has ¾" schedule 80 welded ends. It has a restriction inside to create a differential pressure in the flowing product

5.5.2. Impulse Pipes

The impulse pipes are made of 1/8" OD stainless steel tubing. They convey the differential pressure signal to the transmitter

5.5.3. Impulse Pipe Connectors

The impulse pipe connectors, part numbers 10501554 and 10920046, connect the impulse pipes to the transmitter and metering section respectively.

5.5.4. Transmitter

The transmitter, part number 10673778, is a Rosemount model 2024. It converts and conveys the pneumatic differential pressure signal from the metering section to the processor in the form of an electrical current. When there is no product flowing in the metering section the output current should be 4.00 mA. At its maximum output of 622 mbars the transmitter should put out 20.00 mA. The transmitter should always be closed to prevent water from entering its chambers. One end cap may be removed but only for access or inspection of electrical connections. Refer to the Flow meter manual for more detailed instructions.

5.5.5. Flow Processor

The flow processor, part number 10945876, is a Flowcom LC. It accurately calculates the flow rate and total amount delivered. There are a number of different software versions on the market today. Currently, versions 1.07, 1.08 and 1 09 are available. Version 1 09 requires that a dip switch inside the meter needs to be turned off during the calibration process whereas the older versions do not Please refer the flow meter manual for further information.

5.6. *Ticket Printer*

The ticket printer is mounted in a stainless steel housing which mounts to the skid. Since the printer is wired directly to the flow processor the power and data transfer are controlled by the processor only. For more information see the flow meter instruction manual.

5.6.1. Stainless Steel Enclosure

The stainless steel enclosure protects the printer from moisture, physical damage, and allows the printer to be stowed away and locked. The enclosure also includes a device which protects the printer from reverse polarity. If the printer is wired up but no lights come on, check the wiring for proper polarity.

5.6.2. Key

The printer key closes and locks the enclosure. To prevent from losing the key a cable may be used to secure it near the printer box.

5.6.3. Printer

The ticket printer is an Epson TM/295. Since it has no on/off switch power is supplied by the processor only. The release button opens the aperture allowing a ticket to be slipped into place. Pressing the forward or reverse button briefly will lock the ticket into place. Press "clear/print" on the processor to print out a ticket.

5.7. *Calibration Cable*

There is a calibration cable available should you wish to calibrate your Flow meter. The part number is 10958052. It allows you to calibrate using a laptop computer.

5.8. *Calibration Software*

A diskette from MVE is available which allows you to communicate with your Flow meter The software package is called Telix and it allows your keyboard to input information to the Flow meter. The part number for the Telix diskette is 10962844.

6. Specifications

6.1. *Storage Tank*

6.1.1. Dimensions

Diameter	32.0 in.	(81.3 cm)
Height	72.5 in.	(1.84 m)
Empty Weight	800 lb.	(363 kg)
Filled Weight*	2100 lb.	(952 kg)

6.1.2. Capacity

Volume	152 gal.	(576 l)
Mass CO_2*	1300 lb.	(590 kg)

6.1.3. Performance

Evaporation Rate	6.5 lb./day	(2.9 kg/day)

6.1.4. Components

Relief Valve Setting † 350 psig	(24.1 bar)
Rupture Disk Setting 450 psig	(31.0 bar)
Liquid Fill Connection	5/8" Flare
Liquid Delivery Connection	¾" FPT Coupler
Vent Connection	5/8" Flare

6.1.5. Construction

Inner Vessel Material	Stainless Steel
Outer Vessel Material	Stainless Steel
Liquid Level Gauge	Magnetic Float Gauge

6.2. *Skid Assembly*

6.2.1. Dimensions

Height	54 in.	(1.38 m)
Width	38 in.	(97 cm)
Depth	38 in.	(97 cm)
Weight	300 lb.	(140 kg)
Total Height with Tank	80 in.	(2.0 m)

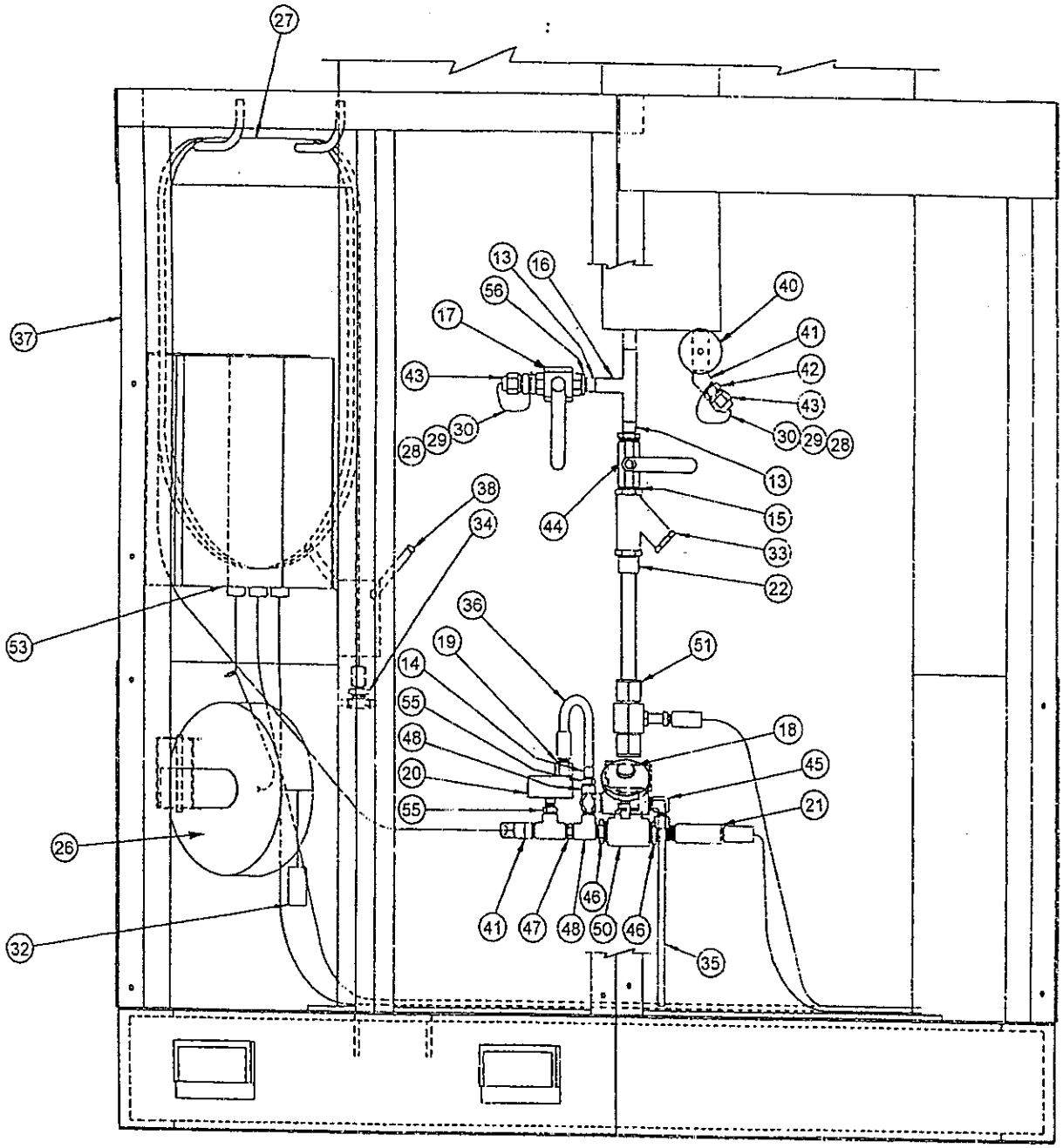
6.2.2. Construction

Skid Material	Carbon Steel ‡

* Liquid CO_2 @ 300 psia
† Primary. ASME Coded
‡ Painted to Customer Specifications

7. Parts Identification

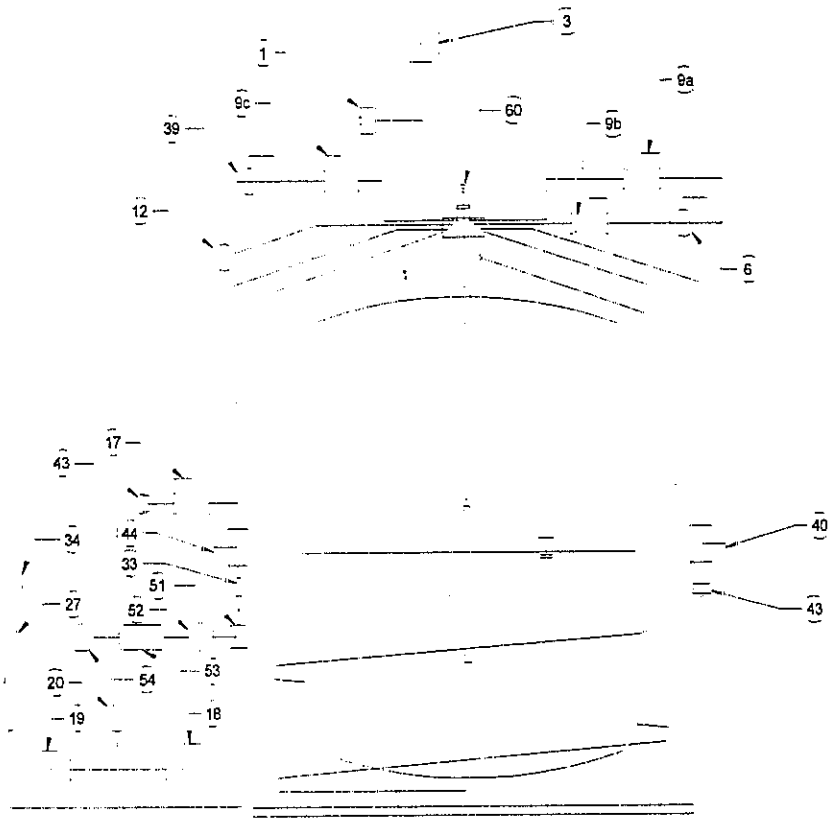
7.1. Skid Assembly Schematic



7.2. Skid Assembly Parts List

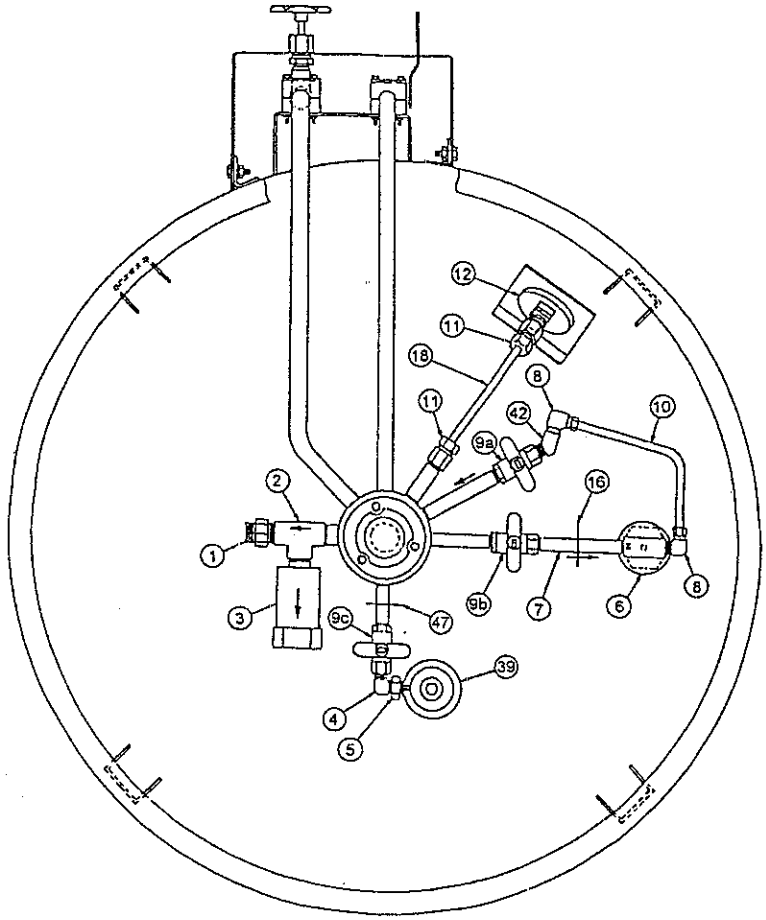
Item	Description	Part No.	Function
13	Stainless Nipple Toe 3/8NPT (2)	1310941	Connects ball valves to stainless tee
14	Stainless Nipple Toe 1/4NPT	1310951	Connects line pressure relief tubing to bushing
15	Stainless Steel Nipple 3/4 NPT	1311551	Connects ball valve to strainer
16	Stainless Tee 3/4" ODT	1410101	Directs liquid line components
17	Brass Ball Valve 3/4 NPT	9111082	Isolates liquid fill line
18	Rego Shut-Off Valve 3/8 FPT	1713202	Allows liquid delivery line to be drained
19	Relief Valve 450 psi	1811472	Protects liquid delivery line from over-pressurization
20	Pressure Gauge 0-400 psi	2012019	Indicates liquid delivery line pressure
21	Temperature Sensor (Optional)	10918608	Provides temperature data to flow processor
22	Stainless Nipple Toe 3/4NPT (2)	1310821	Connects metering section to liquid delivery line
26	Electrical Cord Reel 50'	4615229	Provides adjustable extension cord for flow meter
27	Flex Hose 1/2x3/4 MPT 35' LG.	3711087	Allows flexibility in making liquid transfers
28	Brass Beaded Chain (2)	4510012	Prevents cap nut from getting lost
29	Brass Coupling 3/16" (2)	4510022	Holds beaded chain in place
30	Brass Coupling 1/8" (2)	4510042	Holds beaded chain in place
32	Cigarette Lighter Adapter	4615219	Allows flow meter to adapt to a cigarette lighter
33	Bronze Strainer 3/4 NPT	4910172	Filters liquid product
34	Quick Coupler 3/4 FPT	10848224	Provides quick connection to customer's fill valve
35	Copper Tubing 3/8 ODT x 10"	10591019	Drains excess line pressure out through the bottom
36	Relief Valve Tubing Assembly	5523539	Directs line pressure relief valve downward
37	Carbon Steel Frame	10712765	Allows tank to be easily transported
38	Quick Connect Wrench	9720959	Eases the attachment of the quick connector
40	Bronze Globe Valve 3/8 NPT	1710972	Isolates vent line
41	Street Elbow 45D 3/8NPT (2)	1211722	Directs liquid and vent line components
42	Brass Conn. 3/8MPT x 5/8 Flare	1110112	Provides the necessary 45D flare fitting for CO2
43	Brass Cap Nut 5/8" Flare (2)	1110422	Protects liquid fill fitting, Protects vent fitting
44	Brass Ball Valve 3/4 NPT	9111082	Controls flow through liquid delivery line
45	Brass Elbow 3/8ODT x 3/8 MPT	10501706	Directs line drain tubing downward
46	Hex Bushing 1/2FPTx3/4MPT(2)	1210062	Directs liquid delivery line components
47	Brass Hex Nipple 3/8 NPT	1310072	Connects liquid delivery line components
48	Brass Street Tee 3/8 NPT (2)	1211112	Directs liquid delivery line components
50	Brass Tee 3/4 FPT	1212362	Directs liquid delivery line components
51	Metering Section 3/4"	10945884	Creates differential pressure in flowing product
53	Flow Processor	10945876	Calculates flow rate and total amount delivered
55	Hex Bshg 1/4FPT x 3/8MPT (2)	1210022	Connects relief valve assembly to delivery line
56	Hex Bushing 1/2FPT x 3/4MPT	1210052	Connects ball valve to liquid line

7.3. Plumbing Schematic



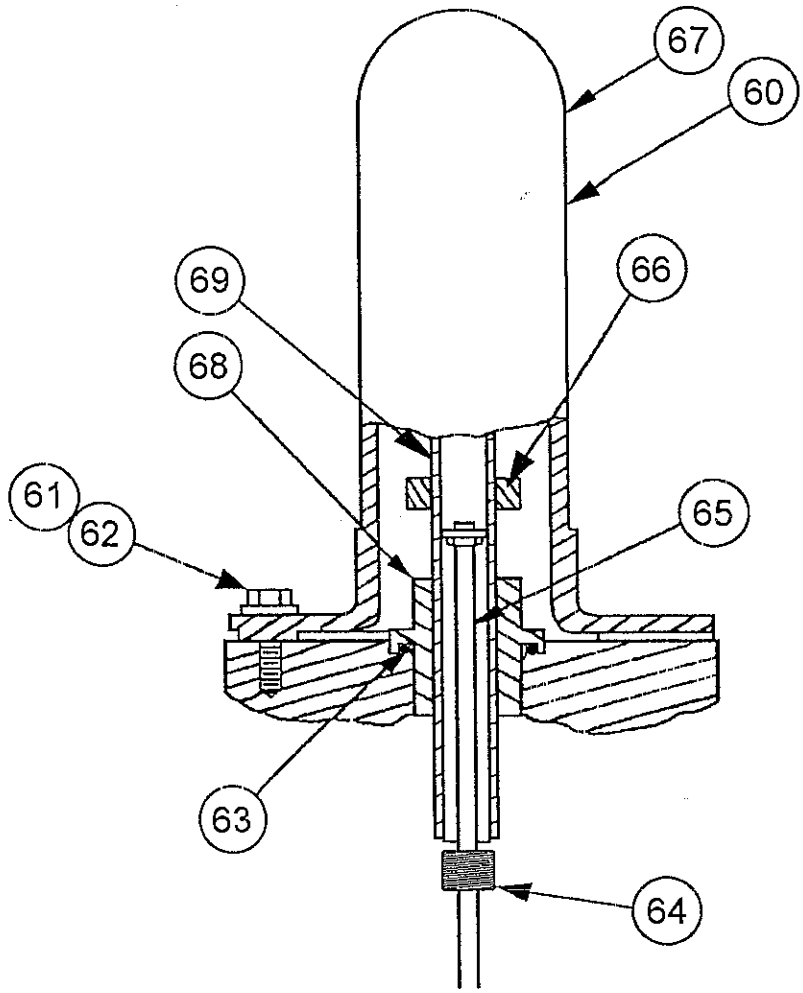
Item	Description	Part No.	Function
1	Rupture Disc 450 psi	1911482	Provides secondary tank safety pressure relief
3	Relief Valve 350 psi 1/2 MPT	1811842	Provides primary tank safety pressure relief
6	P.B. Regulator 300 psi 1/4 NPT	2110742	Maintains tank pressure at 300 psi
9a	Ball Valve 1/4 NPT	1716182	Isolates pressure building regulator
9b	Ball Valve 1/4 NPT	1716182	Isolates pressure building regulator
9c	Ball Valve 1/4 NPT	1716182	Isolates 325 psi relief valve
12	Pressure Gauge 0-400 psi	2012429	Indicates tank pressure
17	Brass Ball Valve 3/4 NPT	9111082	Isolates liquid fill line
18	Rego Shut-Off Valve 3/8 FPT	1713202	Allows liquid delivery line to be drained
19	Relief Valve 450 psi	1811472	Protects liquid delivery line from over-pressurization
20	Pressure Gauge 0-400 psi	2012019	Indicates liquid delivery line pressure
27	Flex Hose 1/2x3/4 MPT 35' LG.	3711087	Allows flexibility in making liquid transfers
33	Bronze Strainer 3/4 NPT	4910172	Filters liquid product
34	Quick Coupler 3/4 FPT	10848224	Provides quick connection to customer's fill valve
39	Regulator 1/4 NPT 325 psi	2110752	Protects integrity of primary relief valve
40	Bronze Globe Valve 3/8 NPT	1710972	Isolates vent line
43	Cap Nut	1110422	Protects liquid fill fitting, Protects vent fitting
44	Brass Ball Valve 3/4 NPT	9111082	Controls flow through liquid delivery line
51	Metering Section 3/4"	10945884	Creates differential pressure in flowing product
52	Differential Pressure Transmitter	10673778	Converts pneumatic d.p. signal into a current signal
53	Flow Processor	10945876	Calculates flow rate and total amount delivered
54	Ticket Printer	10918579	Prints out the amount of product delivered
60	Liquid Level Gauge Assembly	5410879	Indicates amount of liquid product in tank

7.4. Top View Plumbing Components



Item	Description	Part No.	Function
1	Rupture Disc 450 psi	1911482	Provides secondary tank safety pressure relief
2	Brass Tee 1/2 FPT	1210642	Connects relief devices to safety vent circuit
3	Relief Valve 350 psi 1/2 MPT	1811842	Provides primary tank safety pressure relief
4	Brass Street Elbow 1/4 MPT	1212562	Connects hex nipple to isolation valve
5	Brass Hex Nipple 1/4 NPT	1310092	Connects 325 psi relief valve to hex nipple
6	P.B. Regulator 300 psi 1/4 NPT	2110742	Maintains tank pressure at 300 psi
7	Stainless Steel Nipple 1/4 NPT	1310521	Connects pressure building reg. to islolation valve
8	Brass Elbow 5/16ODT x 1/4MPT	1013042	Connects tubing to pressure building components
9a	Ball Valve 1/4 NPT	1716182	Isolates pressure building regulator
9b	Ball Valve 1/4 NPT	1716182	Isolates pressure building regulator
9c	Ball Valve 1/4 NPT	1716182	Isolates 325 psi relief valve
10	Stainless Tubing 5/16 OD x 7.5"	2713011	Directs pressure building circuit
11	Brass Conn. 1/4ODT x 1/4FPT	10501061	Connects tubing to pressure gauge components
12	Pressure Gauge 0-400 psi	2012429	Indicates tank pressure
16	Pressure Building Label	3811619	Displays pressure building circuit
18	Stainless Tubing 1/4 OD x 12"	2710051	Directs pressure gauge line
39	Regulator 1/4 NPT 325 psi	2110752	Protects integrity of primary relief valve
42	45 Degree Street Elbow 1/4MPT	1210472	Connects isolation valve to elbow
47	Vent Label	3811609	Displays top vent line

7.5. Liquid Level Gauge Assembly



Item	Description	Part No.	Function
60	Magnetic Sight Gauge Assy.	5410879	Displays amount of liquid CO2 in the tank
61	Hex Head Machine Screw (3)	2910541	Secures sight gauge protector to tank
62	Flat Washer (3)	2910591	Protects sight gauge protector from screws
63	O-Ring	2300059	Seals sight gauge assembly to tank
64	Extension Spring	5410591	Provides necessary tension for float rod
65	Float Rod Assembly	5410869	Reads the liquid level in the tank
66	Orange Ceramic Magnet	4613989	Displays amount of liquid CO2 in the tank
67	Clear Sight Gauge Protector	5410786	Protects liquid level gauge
68	Knuckle Plug	4412902	Secures sight gauge assembly to tank
69	Magnetic Gauge Tube	4613999	Provides mechanism for reading liquid level

8. Operating Instructions

8.1. Preparing the Tank For Filling

Before filling the VLCD-1300 with liquid CO_2 make sure the tank is pressurized to at least 70 psi. If the tank has less than 70 psi the liquid CO_2 will freeze in the line and the transfer process will stop altogether. Add CO_2 gas to the tank until the pressure reaches 70 - 100 psi. Refer to the section entitled Using an Outside Source to pressurize the tank. If, on the other hand, the pressure in the VLCD is above 150 psi the time required to make a transfer may be excessive. Vent the VLCD-1300 outdoors if it contains more than 150 psi. See section Manual Venting to vent the tank.

8.2. Filling with Liquid CO_2

The VLCD-1300 is typically filled from a vertical bulk tank using gravity feed. The following steps should be taken:

1. Relocate the VLCD tank to a preferred position while the tank is empty.
2. Check to see that the VLCD-1300 is pressurized to at least 70 psi but less than 150 psi.
3. Make sure that all valves are closed.
4. Remove the fill line cap nut from the fill fitting
5. Connect a standard CO_2 fill hose which has 45° flared 5/8" OD fittings to the liquid fill connection on the VLCD-1300.
6. Verify that the fill hose is properly and securely connected to the bulk tank and the VLCD.
7. Make sure the bulk delivery hose has a line drain valve.
8. Close the bulk tank's line drain valve.
9. Slowly open the liquid fill valve on the VLCD to allow the pressure in the hose to equalize with the pressure in the VLCD tank.
10. Next, slowly open the delivery valve on the bulk tank to begin the flow of product from the bulk tank to the VLCD.
11. Monitor the liquid level gauge on the VLCD as the filling process takes place.
12. Monitor the VLCD's tank pressure gauge as it fills.
13. When the pressure in the VLCD reaches 300 psi remove the vent cap nut and open the vent valve slightly
14. Vent the product outside or back into the mother tank using a vapor return line.
15. Never vent the tank indoors.
16. Maintain the VLCD's tank pressure near 300 psi as the filling process nears completion by opening the auxiliary vent isolation valve and throttling the manual vent valve.
17. Just before liquid product starts to exit through the vent valve shut off the liquid fill valve on the mother tank.

8. Operating Instructions

1. If a crossover valve is available open it now to push the remaining liquid CO_2 out of the hose and into the VLCD-1300.
2. Next, close the VLCD's vent valve.
3. Further, close the VLCD's fill valve.
4. If a crossover valve is not available, quickly open the line drain valve on the mother tank to vent the delivery hose.
5. Disconnect the delivery hose from the VLCD and return it to its storage hook or reel.
6. Replace both cap nuts on the VLCD to protect the fill and vent fittings.
7. Open the pressure building isolation valves.
8. Open the auxiliary vent isolation valve.

At this point the VLCD-1300 should contain 1300 pounds of liquid CO_2 at a pressure of 300 psi in a preferable location such as on a truck bed. Given these conditions the tank is now ready to be used to deliver bulk CO_2.

8.3. Delivering Liquid CO_2

The delivery process is somewhat complicated by the fact that there are a number of different tank, fill box and fill line designs on the market. However, there are enough similarities so that general rules may be followed. The generalized procedure for filling restaurant bulk CO_2 tanks is described below.

1. Locate the VLCD-1300 as near as possible to the fill station.
2. Put on work gloves and safety goggles.
3. Make sure the flow meter is plugged into a cigarette lighter.
4. Unlock the fill station and inspect the fill fitting and the box's general condition.
5. Do not attempt to make a delivery if the fill fitting is damaged, the box is in poor condition or if the box is located below grade or in a confined space.
6. Exercise good judgment and do not underestimate the physiological effects CO_2 may have on you.
7. Unhook the store tank and move it outside if it is a portable model.
8. Once satisfied with the appearance and condition of the fill fitting inspect the contents gauge on the store tank to predict the amount of product that will be delivered.
9. Remove the fill hose from its storage hooks or hose reel and connect the fill hose fitting to the fill box fitting.
10. Make sure the fittings are completely tight such that the circular slot on the fill fitting is even with the end of the hose fitting.
11. Check the line pressure gauge to determine the store tank pressure.

12. If the line pressure gauge reads zero the store tank either has a one way check valve or a fill line isolation valve which is closed.
13. Open the store tank's fill line isolation valve if necessary and check the pressure once again.
14. Once satisfied that the VLCD has approximately 300 psi and the store tank fill line is open and has approximately 125 psi switch on the flow processor and open the printer cabinet.
15. Press the "Release" button on the printer and insert a ticket form.
16. Press the "Forward" button briefly to lock the ticket into place.
17. Open the VLCD's liquid delivery valve slowly at first and then open it further gradually while monitoring the flow processor.
18. If the processor reads "H98" partially close the valve until the error message ceases.
19. Keep the flow rate between 20% and 95% of maximum as shown on the processor.
20. At any point in the fill process you may close the liquid delivery valve and check the pressure or liquid contents of either tank.
21. If the flow rate drops below 20% close the liquid delivery valve.
22. Vent the store tank outdoors down to 100 psi if possible.
23. If the store tank cannot be vented down and the maximum flow rate drops below 20% discontinue filling.
24. Close the liquid delivery valve.
25. Open the line drain valve allowing the liquid trapped in the hose to escape.
26. Once the escaping fluid in the hose changes from a liquid to a gas close the line drain valve.
27. Press print on the flow processor to print out a ticket.
28. Insert another ticket and press print again if a duplicate is required.
29. Disconnect the fill fitting from the fill box slowly allowing gas to escape.
30. Return the fill hose to the hose hooks or hose reel.
31 Open the line drain valve to allow any gas left in the hose to escape.
32. Switch off the flow processor, close the printer box and store the key.
33. Close and lock the fill box.
34. Disconnect the electrical cord from the cigarette lighter and return to cord reel.
35. Remove safety goggles and gloves.

8.4. Venting the Tank

The VLCD-1300 may be vented to protect the primary relief valve, to decrease the time required to fill the VLCD, or to achieve other goals. The auxiliary and manual vent lines may be used for these purposes.

8. Operating Instructions

8.4.1. Manual Venting

The manual vent valve, item 40, may be used for this purpose. If the tank needs to be vented open the valve to achieve the desired rate. Always vent the tank outdoors either by placing the tank outside or by routing a vent hose out of the building. Secure the exhaust end of the hose so that it doesn't whip about while in use.

8.4.2. Auxiliary Venting

The auxiliary vent valve, also known as the pressure control valve, is an economizer regulator which vents the tank at or above 325 psi. It should be used when filling from a bulk tank because it allows excess pressure to bleed off without wasting product. The auxiliary isolation valve, item 9c, activates the pressure control valve. The auxiliary vent circuit should always be left on.

8.5. Pressurizing the Tank

The VLCD-1300 may be pressurized by using an internal vaporization coil or by using an outside source.

8.5.1. Pressure Building

If the pressure in the tank is below 300 psi the pressure building circuit may be used to generate pressure in the tank. Open the P.B. isolation valves, items 9a and 9b, to allow liquid to enter the coil. The effectiveness of the pressure building circuit depends on the energy state of the liquid inside the tank. For example, if the tank pressure is maintained at 100 psi for a long period of time the energy state of the liquid will be much lower than if the tank was maintained at 300 psi. As a result the pressure building rate will be lower for the tank when it is maintained at 100 psi rather than at 300 psi. In summary, maintaining the tank near 300 psi will maximize its performance.

8.5.2. Using an Outside Source

An outside source such as a high pressure cylinder, liquid cylinder, or other source may be used to pressurize the tank. After removing the protective cap nut from the vent line, attach a hose which as 45° flared 5/8" OD fitting to the VLCD-1300. If a high pressure source is used install a pressure control regulator set at 300 psi in line to protect the tank from excessive pressure. After the pressure source has been properly connected to the vent line slowly open the vent valve, item 40, to pressurize the line. Once the line has been pressurized open the gas use valve on the pressure source and monitor the VLCD's pressure gauge until the desired pressure is reached. Close the gas use valve first and then the vent valve. Loosen the hose fittings slowly at first to relieve pressure trapped in the line. Finally remove the hose from both sources.

9. Troubleshooting

Problem	Cause	Solution
Tank builds excess pressure or builds pressure too fast	Low usage	If daily usage is less than 6.5 lb. per day the tank will build pressure.
	Tank is over-filled	If the tank is filled past the vent trycock or past the DOT specified fill weight the pressure may rise rapidly after a fill.
	P.B. regulator is maladjusted	If the pressure builds and stays at a setting higher than desired, adjust the pressure building regulator to a new setting. Turn the adjustment screw counter-clockwise to lower the pressure setting. Each half turn equals approximately 15 psi.
	P.B regulator leaks	If the pressure builds to the relief valve setting, frost appears at the base of the tank, and the P.B. regulator does not respond to adjustment, replace the regulator.
	Vacuum is deteriorating	This can be accompanied by cold or frost occurring evenly over the tank's outer surface. Phone MVE for return and repair information
Tank pressure is too low or does not build pressure at a sufficient rate	Press. building isolation valves are closed	Open the P.B. isolation valves.
	Press. building regulator is mal-adjusted	If the pressure does not build and stays at a setting lower than desired, adjust the pressure building regulator to a new setting. Turn the adjustment screw clockwise to raise the pressure setting Each half turn equals approx. 15 psi.

9. Troubleshooting

Problem	Cause	Solution
Tank pressure is too low or does not build pressure at a sufficient rate	Tank is leaking	Check for frost at the base of the tank or on top of the head. Spray soap solution on joints to test for leaks. Repair leak if possible otherwise call MVE for assistance.
	Energy level of liquid in tank is low.	The pressure building rate for product stored at a lower pressure will be slower than product stored at a higher pressure. To achieve best results maintain the tank pressure at the working pressure of 300 psi.
	Tank is contaminated with moisture or CO2 by-products	Contaminants such as water will freeze in solution with liquid CO2 preventing adequate flow of product into the pressure building coil. After the VLCD has been emptied purge the tank with 50°C - 100°C nitrogen for 12 hours or more. Purge CO2 byproducts out through the liquid fill line. After donning safety glasses and gloves place a rag over the fill line outlet and open the valve briefly. Inspect the cloth for discoloration or impurities. Repeat until all impurities are removed.
	Dry ice in tank	If the pressure in the VLCD-1300 drops below 61 psi dry ice slush will form in the tank which will restrict liquid CO2 from entering the pressure building coil. To liquefy solid CO2 pressurize the tank using an outside source to 300 psi. Each pound of frozen CO2 will consume one pound of dry CO2 gas. For example, if the VLCD had 50 pounds of solid CO2 it would consume the contents of one 50 lb. high pressure cylinder. Liquefaction is a slow process. It takes 30 minutes to liquefy each pound of solid CO2.

9. Troubleshooting

Problem	Cause	Solution
Frost occurs around the base of the tank regulator.	Tank is building pressure	This is normal if the tank pressure is lower than the setting on the P.B.
	Frost is residual from last fill or earlier use	This is normal. Frost may remain on the tank for hours after a fill or heavy use.
Frost occurs on head or knuckle	Residual frost from last fill or recent use	This is normal. Ice may remain for hours after a fill or heavy use.
Frost occurs evenly on outer surface	Tank has lost its vacuum	This is accompanied by high pressure and product loss. Phone MVE for return information
Miscellaneous frost spots	Tank may have internal damage	Call MVE for evaluation or return information.
Flow meter not working	Wiring problem	Inspect the wires to make sure they are in good condition and properly installed. Refer to the Flow Meter manual for more information
Flow meter not counting	H2O ice in impulse pipes	If any moisture is found in the CO2 supply it will make its way to the flow meter's d.p. impulse pipes and immediately block them To purge the moisture remove each impulse pipe and force warm nitrogen through them at 1000 psi (70 bars) if possible. This will insure that the impulse pipes are absolutely dry.
	Dry ice in impulse pipes	To avoid dry ice forming in the impulse pipes pressurize the metering section with CO2 gas above 70 psi before introducing liquid CO2. This can be done by connecting the delivery hose to the customer station allowing pressure to build back into the metering section.

9. Troubleshooting

Problem	Cause	Solution
Flow meter not counting	Impulse pipes crossed	Make sure the impulse pipes are connected properly. The "+" side on the metering section must be connected to the "H" port on the transmitter. In addition, the "-" side on the metering section must be connected to the "L" port on the transmitter. Make sure the fittings are secure and the impulse pipes are not kinked or blocked.

10. Service and Maintenance

10.1. Maintaining the VLCD-1300

Since there is no maintenance schedule for the VLCD pay attention to the normal operating conditions of the tank. If deviations are encountered repair or replace the affected parts as necessary.

10.2. Servicing the VLCD-1300

Repairs should only be performed by MVE authorized service agents who use MVE replacement parts. Contact MVE for a list of authorized service agents.

10.3. Important Telephone Numbers

Purpose	Contact	Phone Number
Customer Service	MVE Customer Service	(800) 247-4446
Technical Service	MVE Technical Service	(800) 253-1769
Direct Telephone No.	MVE Operator	(612) 882-5000
Service Agent for MVE	_____	_____
_____	_____	_____

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