Product Manual

Trifecta® Pro CO_2 Supply System

Designed and Built by:

Chart Inc.

407 7th Street NW
New Prague, MN 56071 USA
(800) 400-4683

Part Number 22003014

Contents

Revision Log

Revision Level	Date	Description
A	08/25/22	Initial Release
B	12/19/22	Manual Update
C	07/17/2023	Content Updates

Preface

General

The Trifecta® Pro CO_2 Supply System is the preferred solution for helping botanical extractors optimize processes and decrease operational costs. The unit can be operated at pressures up to 850 psig and can provide a continuous flow of high-pressure carbon dioxide. Drawing liquid from a standard bulk tank, the Trifecta system boosts the liquid pressure in each tank using an innovative, dual pass electric pressure building vaporizer. The Trifecta solution requires no downtime while refilling the bulk storage tank. This convenient solution eliminates the need for high maintenance rotating type equipment like pumps and compressors.

Product Highlights

- System utilizes standard medium-pressure CO_2 bulk tank (300 psig suggested minimum) to lower investment and use existing assets.
- No downtime – the system maintains pressure and flow when bulk tank is filled.
- Cylinders switch by pressure instead of level to further reduce product loss and protect against pressure decay.
- Robust design features streamlined all stainless-steel piping with only five control valves and one integrated electronic control system (PLC) for increased durability and reliability.
- Computer-controlled design simplifies installation, start-up and continuous operation.
- Frame assembly features a protective top cover in a compact footprint with an elevated base for improved ventilation.
- Available for CO_2 only (see other Trifecta Pro and XPro literature for LIN, LAR, and LOX options).

Product Manual

The Trifecta Pro CO_2 Product Manual is designed to only be used with the Trifecta Pro CO_2 model. If there are any questions regarding the operation of this system, contact Chart's Technical Service division at 1-800-400-4683.

This manual contains information regarding the safe operation and handling of liquid carbon dioxide with this system. It should be thoroughly read and understood by anyone that operates the equipment.

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

The Introduction section discusses the general features of the system and describes typical layout and flow capacity.

In the Installation section information is available on the best location of the skid, connecting piping, power supply and commissioning of the system.

For information on settings and operation of the system refer to the Operations section.

The Service, Preventive Maintenance, and Troubleshooting sections of this manual should aid in answering common questions about the system. Part numbers are also available for ease of ordering through www chartparts.com.

Terms

Throughout this manual safety precautions will be designated as follows:

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

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

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

Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

ASME	American Society of Mechanical Engineers
BARG	Pressure (Gauge, Metric)
CGA	Compressed Gas Association
CO_2	Carbon Dioxide
DP	Differential Pressure
FPT	Female Pipe Thread
ID	Inner Diameter
kg	Kilogram
MAOP	Maximum Allowable Operating Pressure
MAWP	Maximum Allowable Working Pressure
MPT	Male Pipe Thread
NER	Normal Evaporation Rate
NFPA	National Fire Protection Association
NPT	National Pipe Tapered Thread
PB	Pressure Builder
PLC	Programmable Logic Controller
PN	Part Number
PPE	Personal Protective Equipment
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch (Gauge, Imperial)
SCFH	Standard Cubic Feet Hour

Introduction

General

Congratulations, you are now the owner of a Chart Trifecta Pro Series high-pressure liquid CO_2 supply system. Chart works closely with our customers to ensure the total system is designed properly, making the Trifecta system as effective as possible. Built for long-term durability and industry leading design, these systems give customers the highest performance at the lowest operating cost – all while providing a single point of contact for efficient project management.

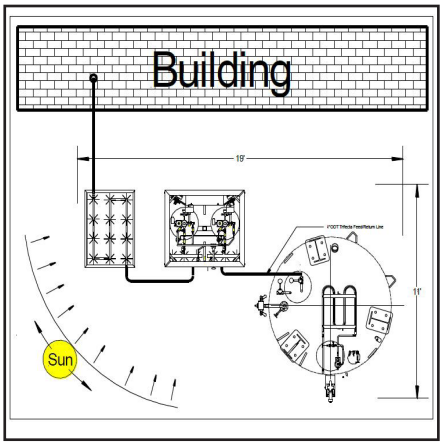
Typical Layout

There are three main components to the "Trifecta" system:

- Standard CO_2 Bulk Tank (Minimum 300 psig)
- Thermablock Electric PB Vaporizer (Integral to Trifecta skid)
- Trifecta Pro CO_2 Skid
- Optional Process Vaporizer for gas applications

The Trifecta Pro CO_2 has been designed for ease of installation and operation. An ideal install has the Trifecta Pro CO_2 skid close to the liquid use valve on the bulk tank.

A typical layout is shown here:



Warning! Avoid installing the Trifecta Pro CO_2 near building vents or air intakes. Carbon Dioxide may displace oxygen necessary to support or sustain life leading to unconsciousness and serious injury, including death.

Flow Capacity

The Trifecta Pro CO_2 system is designed to supply high-pressure liquid CO_2, while the reserve tank is being filled with lower pressure liquid. Its priority is to maintain supply pressure at or above the required pressure setting. The unique design has self-contained diagnostics that alert the operator when the process exceeds the flow rating of the Trifecta.

The Trifecta Pro CO_2 can supply liquid carbon dioxide at a maximum allowable working pressure of 930 psi.

Service	MAWP* (PSIG)	MAOP** (psig)
CO_2	930	850

*MAWP = MAXIMUM ALLOWABLE WORKING PRESSURE
**MAOP = MAXIMUM ALLOWABLE OPERATING PRESSURE

The system uses a 40kW Thermablock electric vaporizer to maintain pressure by converting the carbon dioxide into high-pressure gas.

The Trifecta Pro CO_2 was developed and tested by Chart's New Product Development group in Ball Ground, Georgia.

The flow performance depends on the ability of the total system to:

- Build pressure in the transfer tanks using gravity and electric heater rods.
  - Extreme weather conditions, and/or duty cycles, may require the addition of higher capacity vaporizers.
- Vaporize liquid into gas to maintain pressure and flow at the use point. (For gas use applications)
  - The vaporizer must be sized for the flow/pressure requirements and duty cycle.
- Fill times - refilling the reserve tank from the bulk tank prior to the primary tank emptying.
  - The overall flow rate of the system can be limited by the system's ability to refill. Flow out cannot exceed flow in!
  - Special care must be given in the selection of the bulk tank that supplies the Trifecta.
  - The tanks heat leak performance is critical in transferring refrigerated compressed gas in the liquid state to the Trifecta.
  - Liquid use lines and valves out of the bulk tank must

be sized properly. Small restrictive liquid lines and valves will increase fill times and increase losses.

– The pressure building system of the bulk tank needs to be sized to build tank sub-cool The sub- cool condition (pressure above the liquid saturation pressure) helps keep flow rates up and the CO_2 in the liquid state as it travels to the Trifecta.

– Liquid feed lines from the bulk tank to the Trifecta must be kept as short as possible. Longer liquid fill lines will lead to longer fill times and additional losses. Take great care in laying out your Trifecta system. Insulating the liquid feed line will reduce its effective length resulting in decreased fill times and reduced losses.

Safety

General

All operators should have a full and complete understanding of the content of this manual before operating the equipment described. This manual is intended to describe the operation of the equipment and not intended to supersede any site-specific standards.

As with any refrigerated system, it should be observed that any non-insulated piping can get extremely cold and should not be touched by exposed skin. Non-insulated piping between the Thermablock vaporizer outlet and Tank inlet may become extremely hot. Caution should be used before handling with exposed skin due to burn risk. If the system requires maintenance, it should be shut down and allowed to warm-up.

If maintenance is to be done on the system, such as changing valve seats, it is extremely important that the pressure be relieved from the system through the vent valves. The five transmitters can monitor the system pressure and liquid levels.

When doing maintenance on the system, it is recommended that the manual isolation valve to the bulk tank be closed.

Caution! All valves on an empty Trifecta system should always be kept closed to protect the inner vessel and plumbing from being contaminated.

Warning! The Trifecta Pro CO_2 has a MAWP of 930 psig and can be operated at pressures up to 850 psig. Special precautions must be taken to ensure that all downstream components and piping have a minimum pressure rating of 930 psig. Special precautions must also be taken when blowing down or servicing the tank.

Caution! Before removing any parts or loosening fittings, empty the refrigerated container of liquid contents and release any vapor pressure in a safe manner.

Safety Summary

Strict compliance with proper safety and handling practices is necessary when using a refrigerated system. We recommend that all our customers re-emphasize safety and safe handling practices to all their employees and customers.

While every possible safety feature has been designed into the unit and safe operations are anticipated, it is essential that the user of the cryogenic/refrigeration system carefully read to fully understand all WARNINGS and CAUTION notes listed in this safety summary and enumerated below.

Also read the information provided in the Safety Bulletin for Oxygen Deficient Atmospheres and Carbon Dioxide following this Safety Summary Periodic review of the Safety Summary is recommended.

External valves and fittings can become extremely cold and may cause painful burns to personnel unless properly protected. Personnel must wear protective gloves and eye protection whenever removing parts or loosening fittings. Failure to do so may result in personal injury due to the extreme temperatures and pressure in the tank.

Warning! Accidental contact of liquid gases with skin or eyes may cause a freezing injury similar to a burn.

Handle liquid so that it will not splash or spill. Protect your eyes and cover skin where the possibility of contact with liquid, cold pipes and equipment, or cold gas exists. Safety goggles or a face shield should be worn if liquid ejection or splashing may occur, or cold gas may issue forcefully from equipment. Clean, insulated gloves that can be easily removed, and long sleeves are recommended for arm protection. Cuffless trousers should be worn over the shoes to shed spilled liquid.

Do not use regulators, fittings, hoses, etc., which have been previously used in a compressed air environment. Failure to comply with these instructions may result in serious damage to the container.

Caution! To prevent possible tip over, do not leave a tank standing upright unless it is secured to its foundation (bolted down).

Transporting and erection of the tank should be performed in accordance with rigging instructions available from Chart. Failure to comply with these instructions may result in serious damage to the container.

Safety Bulletin

Portions of the following information is extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. Additional information on carbon dioxide, oxygen, nitrogen, argon, and cryogenics is available from the CGA at www.cganet.com.

Cryogenic containers, stationary or portable, are from time to time subjected to assorted environmental conditions of an unforeseen nature. This safety bulletin is intended to call attention to the fact that whenever a refrigerated container is involved in any incident whereby the container or its safety devices are damaged, good safety practices must be followed. The same holds true whenever the integrity or function of a container is suspected of abnormal operation. Good safety practices dictate the contents of a damaged or suspect container be carefully emptied as soon as possible. Under no circumstances should a damaged container be left with product in it for an extended period. Further, a damaged or suspect container should not be refilled unless the unit has been repaired and re-certified.

Incidents which require that such practices be followed include highway accidents, immersion of a container in water, exposure to extreme heat or fire, and exposure to most adverse weather conditions (earthquake, tornadoes, etc.). As a rule of thumb, whenever a container is suspected of abnormal operation, or has sustained actual damage, good safety practices must be followed.

In the event of known or suspected container vacuum problems (even if an extraordinary circumstance such as those noted has not occurred), do not continue to use the unit. Continued use of a refrigerated container that has a vacuum problem can lead to embrittlement and cracking.

Prior to reusing a damaged container, the unit must be tested, evaluated, and repaired as necessary. It is highly recommended that any damaged container be returned to Chart for repair and re-certification.

The remainder of this safety bulletin addresses those adverse environments that may be encountered when a refrigerated container has been severely damaged These are oxygen deficient atmospheres, oxygen enriched atmospheres, and exposure to inert gases.

Oxygen Deficient Atmospheres

Warning! Carbon Dioxide vapors in air may displace oxygen necessary to support or sustain life. Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.

The normal oxygen content of air is approximately 21%. Depletion of oxygen content in air, either by combustion or by displacement with inert gas, is a potential hazard and users should exercise suitable precautions.

One aspect of this possible hazard is the response of humans when exposed to an atmosphere containing only 8 to 12% oxygen. In this environment, unconsciousness can be immediate with virtually no warning.

When the oxygen content of air is reduced to about 15 to 16%, the flame of ordinary combustible materials, including those commonly used as fuel for heat or light, may be extinguished. Somewhat below this concentration, an individual breathing the air is mentally incapable of diagnosing the situation because the onset of symptoms such as sleepiness, fatigue, lassitude, loss of coordination, errors in judgment and confusion can be masked by a state of “euphoria,” leaving the victim with a false sense of security and well-being. Human exposure to an atmosphere containing 12% or less oxygen leads to rapid unconsciousness. Unconsciousness can occur so rapidly that the user is rendered essentially helpless. This can occur if the condition is reached by an immediate change of environment, or through the gradual depletion of oxygen.

Most individuals working in or around oxygen deficient atmospheres rely on the “buddy system” for protection - obviously the “buddy” is equally susceptible to asphyxiation if he or she enters the area to assist the unconscious partner unless equipped with a portable air supply. Best protection is obtainable by equipping all individuals with a portable supply of respirable air. Lifelines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If an oxygen deficient atmosphere is suspected or known to exist:

- Use the “buddy system”. Use more than one “buddy” if necessary to move a fellow worker in an emergency.
- Both the worker and “buddy” should be equipped with self-contained or airline breathing equipment.

Carbon Dioxide

The system described in this manual has the ability to hold and dispense carbon dioxide (CO_2) gas under pressure.

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.

CO_2 gas is a colorless, odorless, tasteless gas that displaces oxygen and in certain percentages 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% for less than 15 minutes 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

Warning! It is important to note that unlike nitrogen and argon, exposure to high concentrations of CO_2 can be deadly even when normal percentages of oxygen are present in the surrounding atmosphere.

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 vessel is inside a building 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 vessel 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 or 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 vessels. They should be familiar with all pertinent safety procedures.

Personal Protective Equipment (PPE)

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

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

Installation

Installation Procedure

The installation of the Trifecta Pro CO_2 should be done in the following order:

- Place Trifecta Pro CO_2 Skid on concrete pad next to bulk tank — concrete pad specifications should be in conformance with local building codes and reviewed by a licensed engineer.
- Pipe Trifecta Pro CO_2 liquid fill line to bulk tank labeled "From Bulk Tank". For maximum efficiency, this line should be insulated and no smaller than ¾".
  - Use liquid withdrawal line on bulk tank
- Pipe Trifecta Pro CO_2 gas use line to external vaporizer labeled "To Vaporizer " To minimize ice build-up on pipe, this line should be insulated.
- Connect power supply to dedicated 120V AC, 15-amp circuit (surge suppressor is recommended). Electric PB, 480V AC, 3 phase, 70 Amps.
- Connect ethernet cable (if required).
- Commission Trifecta Pro CO_2 System.

Placement of Trifecta Pro CO_2

The Trifecta Pro CO_2 skid has four lifting lugs on the top of the skid. These lifting lugs allow for placement of the skid by overhead crane. If an overhead crane is not available, the skid has fork truck access as well.

Note: The Trifecta Pro CO_2 assembly weighs almost 1900 lbs. (864 kg) empty.

The Trifecta Pro CO_2 skid should be placed on the concrete pad near the bulk storage tank as seen in the Introduction portion of this manual. The skid should be placed as close to the bulk tank as possible without interfering with any other equipment or service requirements of the tank. The system requires a transfer of liquid and gas between the bulk storage tank and the Trifecta Pro CO_2 skid. This process becomes less efficient with increasing transfer line length.

Note: Each site may have unique requirements; however, it is recommended to follow the basic layout located in the Introduction section of this manual.

The skid should also be placed such that there is easy access to all sides of the unit. The skid should be placed where it may receive a maximum amount of airflow. One must be able to check the individual cylinder gauges, the control box, and any of the actuated valves or transmitters at any time.

Note: Do not locate the Trifecta or Vaporizer near equipment that produces excessive moisture (i.e., cooling towers, drains, etc.).

Liquid Line Piping to Bulk Tank

The Trifecta Pro CO_2 skid requires a liquid line piped from the bulk storage tank. This line will serve two functions. First, to allow the high-pressure gas to return to the liquid side of the bulk tank (reduce losses); second, to allow the transfer of liquid from the bulk tank to the Trifecta. By removing the tube connection between A and B — shown in Fig 1 on next page — the high-pressure vent gas can be separately piped to the gas phase of the bulk tank, or totally vented to atmosphere. Venting the Trifecta to the gas phase is often useful when connecting multiple Trifectas to one bulk tank.

The backside (PB Side) of the Pro Series skid has two/three connection points:

- Connection (A) serves as both the high-pressure gas outlet and the liquid inlet when the tubing connection between A and B is in place.
- Connection (B) is the high-pressure gas outlet when the tubing connector between A and B has been removed.
- Connection (C) is the high-pressure liquid outlet to the process equipment.

The piping and components from the Trifecta Pro CO_2 to the vaporizer (if required) must be at least 3/4" (19mm) copper or its equivalent and of adequate pressure rating. Small diameter lines will introduce undesirable pressure drops and impact overall system performance. For gas applications the outlet should be piped to the customer house line with final line regulation as required.

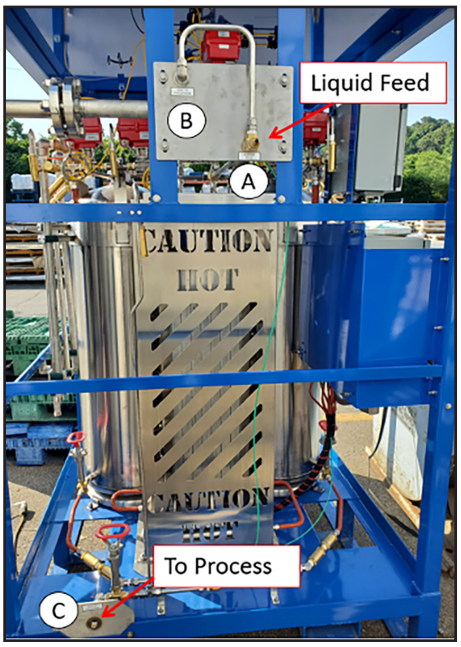


Figure 1. Liquid Line Piping

Note: It is recommended to insulate the liquid feed line to minimize fill times and reduce losses. The fill line (from bulk tank to Trifecta) length should be limited to 15 total feet (5 meters).

Note: The isolation valve on the bulk tank liquid line should not be opened until all plumbing connections are complete.

Piping to Vaporizer (if required)

The Trifecta Pro CO_2system does not contain final vaporization. Consequently, one or more freestanding, external vaporizer(s) must be connected (if gas vaporization is required) to the "to Vaporizer" line of the Trifecta Pro CO_2 The vaporizer(s) should have a pressure rating of at least 1000 psig.

Note: It is important to make sure the vaporizer assembly is protected against over pressurization from trapped liquid. The vaporizer installation must include a thermal relief valve just downstream of the vaporizer, set at 1000 psig (all components used downstream on this piping circuit must all be rated to this pressure).

Note: The relief device (SRV-4) on the Trifecta Pro CO_2 is a fail-safe device and should not be relied upon as the only thermal relief. Operation of the Trifecta Pro CO_2 "Gas Use" relief device may vent cold gas/solids, creating a noticeable vapor cloud.

Bulk Tank Pressure Transmitter

The system controller requires the pressure input of the bulk tank to perform the filling procedure as efficiently as possible. This is done through a pressure transmitter. The pressure transmitter measures the pressure of the bulk tank and sends an electrical signal back to the controller. The transmitter for the bulk tank is in the upper piping of the Trifecta Pro CO_2 and pre-wired into the control box. No additional piping is required by the customer to receive the bulk tank pressure; this will automatically read the current bulk tank pressure, unlike previous models.

Electrical Power Supply

A dedicated 120-volt AC, 60 Hz, 15-amp circuit must be provided to power the Trifecta Pro CO_2 control system. If 120 VAC is not available, an appropriately sized transformer may be necessary. The Allen Bradley PLC is mounted within a NEMA 4 control box as shown in the following photograph (Fig 2).

Note: 480V AC / 3 Phase service is required for the electric pressure building vaporizer.

Figure 2. Allen Bradley Control Panel

It is important that care is taken to install the Trifecta Pro CO_2system on a dedicated electrical power circuit that is clean and protected. Circuits that are susceptible to noise and brownouts may cause erratic system behavior. Care should also be taken to avoid installation on a circuit that regularly gets turned on and off to provide power to another piece of equipment (lights, heaters, cooling systems etc.). It should be recognized that a PLC (computer) controls the Trifecta Pro CO_2 system, and a clean, steady circuit must be used to power the Trifecta Pro CO_2 system.

The electric PB vaporizer requires 480V AC, 3 phase, 70 Amp service.

Commissioning

The following procedures should be followed when first commissioning the Trifecta.

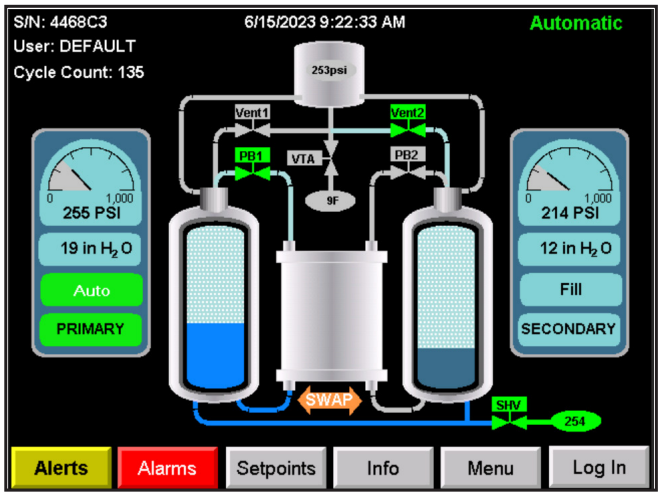
Warning! It is important to purge the entire Trifecta Pro CO_2 and piping with warm, dry, gaseous nitrogen or carbon dioxide before running the system with liquid. Water vapor can cause ice crystals to form that may cause the actuated valves and other critical components to operate improperly. Introducing liquid CO_2 when the vapor pressure is below 80 psig can result in dry ice forming and plugging the lines. Open bulk tank liquid valve slowly to allow vapor pressure to build before flooding the line with liquid.

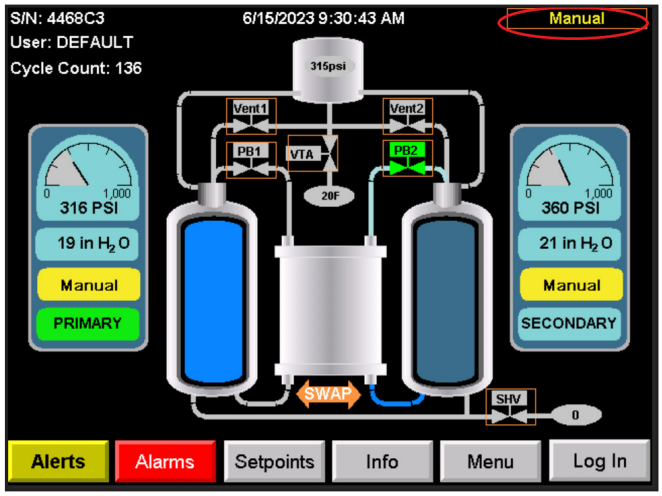
Purge and Pre-Charge of the Trifecta Pro CO_2

Verify that the controller is in the manual mode (see details below) and all valves are closed.

Before beginning purging, in the top right hand of the screen should say “Manual.” If it says “Automatic,” you will need to change it to manual.

First, you will touch Automatic on the main screen. This will put it in a manual mode.



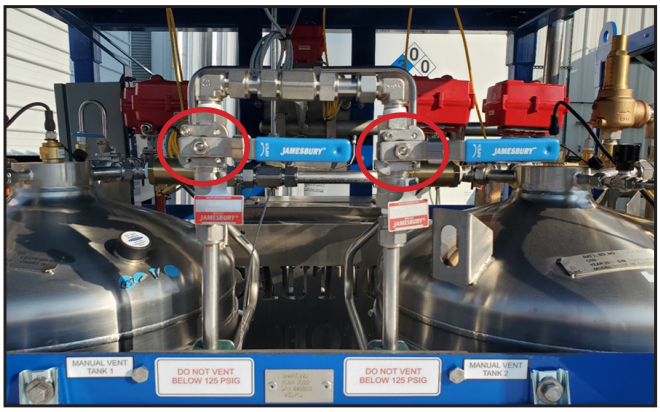


Note: The mainscreen can be used to manually open/close all the actuated valves. This will be required for initially purging the Trifecta and for troubleshooting.

Open the purge valves on the safety circuit (V-3).

Cycle the diverter valve (DIV-1) to purge out of both purge valves (V-3). (Do this for tank 1 and tank 2.)

Open both manual vent valves located above the control box (V-1).



Purge for one minute.

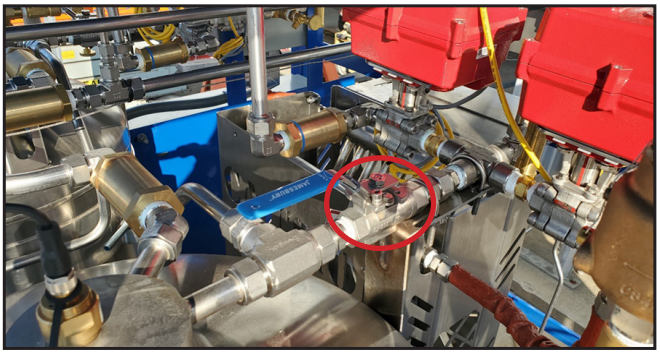
Close the manual vents (V-1).

At any time during the purging process, if the pressure gets down to 125 PSI, stop purging and open the liquid line on the bulk tank to let the Trifecta equalize with the bulk tank again.

Note: Remember to shut the liquid line on the bulk tank before resuming purging.

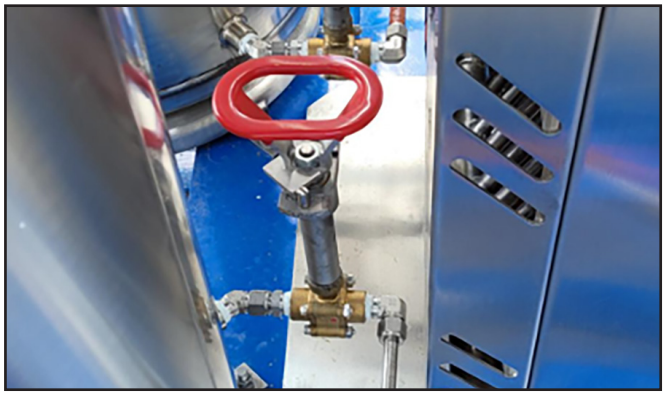
Close the PB Isolation valve on the bottom of tank 1 and tank 2 (V-2).

Close VENT/PB Isolation valve on the top of tank 1 and tank 2 (V-4).



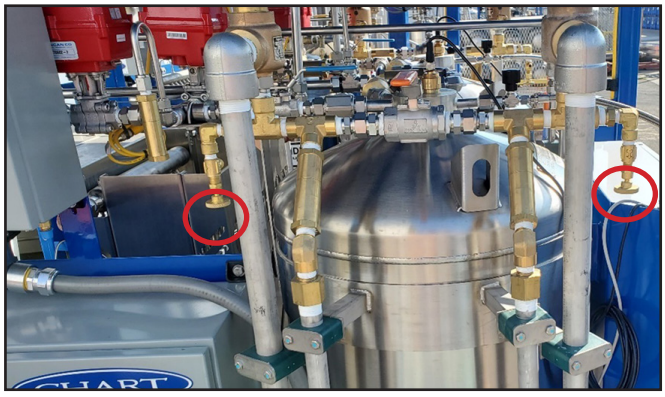
Open the purge valves (V-8) on the upstream side of the ½" actuated ball valve on both tank 1 and tank 2.

Open the P B Isolation valve on the bottom of tank 1 and tank 2 (V-2).

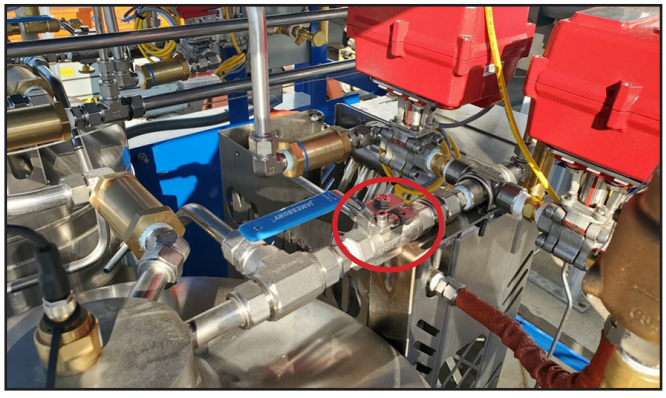


Allow purge gas to flow out of each purge valve for 10 to 15 seconds.

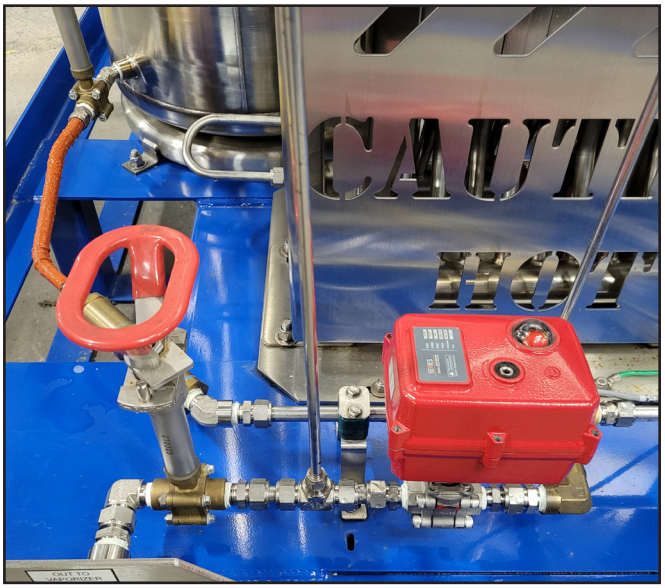
Close the purge valves on the upstream side of the ½" actuated ball valve on both tank 1 and tank 2.



Open VENT/PB Isolation valve on the top of tank 1 and tank 2 (V-4).



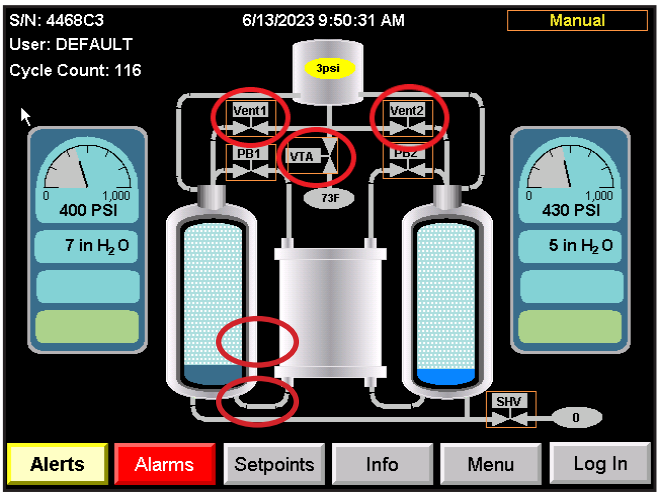
Slowly open the liquid use valve (V-5).



Leak check all pressurized lines.

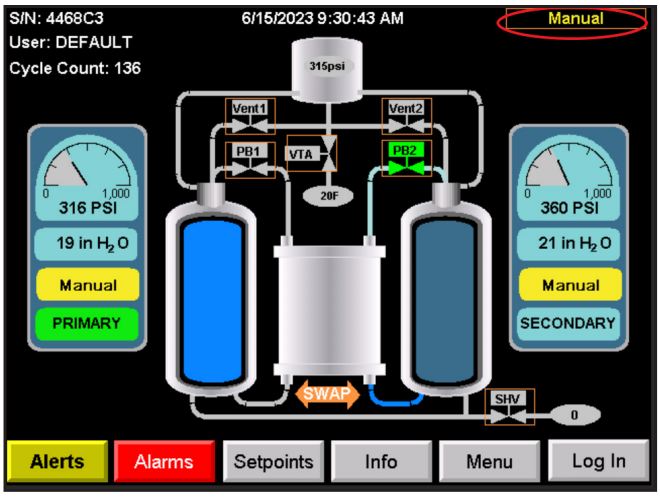
Close the liquid use valve (V-5).

Open the vent to bulk actuated valves and the vent to atmosphere actuated valve on the Main Screen to purge through the auto vent plumbing circuits.



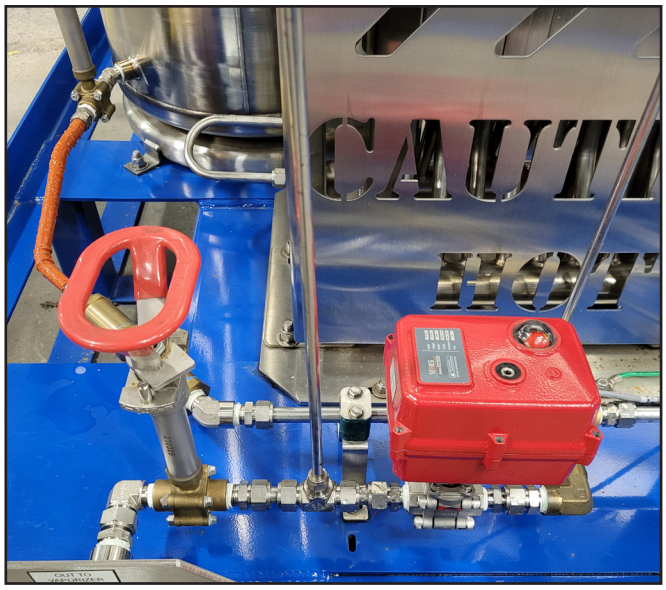
Open the liquid line on the bulk tank and let it equalize with the Trifecta Pro CO_2.

From the Main Screen, put the unit into Auto by pressing the Manual Button. Both tanks should now begin to fill and pressurize.



Once both tanks are filled and pressured up, allow all lines to thaw if necessary.

Leak check entire system at the operating pressure, 850 psi.



Slowly open the liquid use valve (V-5) to pressure up the process vaporizer (if equipped) and house lines.

Leak check the house lines at operating pressure.

Check Trifecta Pro CO_2 Cylinder Relief Valves

Check each cylinder's main relief valves. During operation, the pressure in tank one and/or two will rise to approximately 850 psig The relief valve must not open. If it does, the valve should be replaced as it is opening at a pressure that is too low. Repeat same procedure on tank two. Open diverter valve for each cylinder to verify secondary set of safety devices.

Operation

The Trifecta Pro CO_2 operation is based on pressure first and liquid level second. This logic assures that the system pressure is maintained. Pressure is the primary concern.

Hard Sets (Complete Parameter List)

The following table is intended to give detailed information on the internal parameters. Most of these settings are hard-coded into the program and password protected.

They cannot be changed by the operator.

Table 1 - 930 psi CO_2

930	MAWP (psi)
48	Secondary Fill Level Setpoint (Inches of H2O)
30%	Primary Too Low To Be Assisted Multiplier %
90%	Secondary Too Low To Assist Multiplier %
15	Primary PB OFF Value Added from Primary PB ON (psi)
835	Primary PB ON (psi)
850	PB ON Upper Limit (psi)
25	Secondary PB OFF Value Subtracted from Primary PB ON (psi)
50	Secondary PB ON Value Subtracted from Primary PB ON (psi)
300	Bulk Tank Critical Setpoint (psi)
920	Tank 1 Pressure Relief Setpoint (psi)
920	Tank 2 Pressure Relief Setpoint (psi)
-5	Pressure Transmitters Too Low FAULT Setpoint (psi)
1060	Pressure Transmitters Too High FAULT Setpoint (psi)
-0.7	Level Transmitters Too Low FAULT Setpoint (Inches of H2O)
55	Level Transmitters Too High FAULT Setpoint (Inches of H2O)
30	Liquid Sensed at Vent via Temperature Time Delay (sec)
120	Vent Temperature Disarm Time on Pressure Relief FAULT (sec)
10	Fast Drop Check Time (sec)
1250	Slow Fill Time Resulting in Vent Open (sec)
40	Below Critical Vent To ATM (Bulk PSI + 40)
45	Low Loss Setpoint Vent Off: Sec Press < (Bulk PSI – 45)
30	Low Loss Setpoint Vent On: Sec Press > (Bulk PSI – 30)
30	Secondary Assist to Primary when < PB ON and Alarm (sec)
120	Pri & Sec Pressure < Primary PB ON Alarm Delay Time (sec)
360	Secondary Filling Too Long Alarm Setpoint (sec)
44	Primary Level To Start Check of Discharge Rate (Inches of H2O)
37	Primary Level To Stop Discharge Rate Check (Inches of H2O)
-20	Vent Temperature Alarm Setpoint (°F)
1200	Fill Duration Timer (sec) Stops Fill
200	Bulk Tank Low Pressure
125	Low Tank Pressure

**causes system to go into "Manual Mode"*

WATLOW QUICK START GUIDE

EZ-LINK. APP for EZ-ZONE. PM

For Part Numbers:
PM6_ _ _ _-(B,E,F,G,H,J,K,)_ _ _ _ _ _ _

WATLOW
Set up your new Watlow EZ-ZONE. PM the easy way with our EZ-LINK. mobile app!
Google play App Store

For assistance contact Watlow: www.watlow.com
1-800-WATLOW2 (1-800-928-5692)
wintechsupport@watlow.com
http://www.watlow.com/EZLINK

1952-8909 Rev B
March 2018

1. Identify a Bluetooth®-Enabled Unit (P/N or Display)

PM 6 _ _ _ _ -B _ _ _ _ _ _ _ _

The EZ-ZONE® PM controller or limit controller includes Bluetooth® wireless technology when:

- Part number includes one of the following designations: B,E,F,G,H,J or K
- The display indicates bttH is on or oFF as shown at the left when you turn power on to the EZ-ZONE PM immediately after displaying the firmware version.

Note:
If Bluetooth® is off, see section 2 to turn it on.

2. Turn Bluetooth® On/Off in the Controller

Starting at the Home Page:

1. To enter the setup page press and hold ▲ and ▼ until SEt appears in lower display. (LoC will appear for PM Express)
2. Press ▲ several times until 9LbL appears in the upper display. (skip this step for PM Express)
3. To enter the global menu press ⊙. (skip this step for PM Express)
4. Press ⊙ several times until bttH appears in the lower display.
5. Press ▲ to turn Bluetooth® on or oFF.
6. To exit the setup page press ⊙ or ⊙ twice.

3. Connect to a Controller with the App

Note:
When more than one controller is installed nearby, use the device view in the app to give each controller a unique name to make it easy to find the right one.

1. Download EZ-LINK™ from the app store for your mobile device and open it.
2. If more than one controller is in range, tap one of the **PING** buttons to identify the controllers. Otherwise tap the name of the controller to connect.
3. If the controller displaying the pinging animation is the one you want, tap **CONNECT**. Otherwise, tap **DONE** and try another.

4. Limiting EZ-LINK™ User's Access

Use the EZ-ZONE PM controller's security lock features to determine which parameters users can access.

To allow user's to read but not change parameters:

- On the controller's factory page, in the lock menu, set the write security parameter to zero (0).

To prevent user's from accessing the Setup Page via the All Parameters link in the app:

- On the controller's factory page, in the lock menu, change the password enable to on and set the locked access level to three (3) or less.

To change which parameters are listed on the controller's home page and on the dashboard in EZ-LINK:

- On the controller's factory page, in the custom setup menu, select the parameters you want to appear for as many of the custom setup menu options (1 to 20) as needed.
- Set unneeded menus to *None*.

Hints:

- The settings discussed above affect both the EZ-ZONE PM's built-in user interface and the EZ-LINK app.
- When password protection is enabled, the password must be entered via the EZ-ZONE PM's built-in user interface or using Watlow COMPOSER® software in order to access the protected items.
- Change and make note of the user and administrator passwords so that you can access these features via the controller's user interface or Watlow COMPOSER software in the future.
- COMPOSER software offers an easier-to-use and more flexible way to edit what is listed on the EZ-ZONE PM controller's home page.

FCC Compliance

The transmitter module is mounted on the top of the display PC board partially under the LED display module and is visible when display removed from bezel.

Module FCC ID: VPYLBZY Part 15C 2.

Unit is assembled from tested components, complete system not tested.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Compliance Information

Bluetooth® Enabled Product

Models PM6_ _ _ _ _-(B,E,F,G,H,J or K)_ _ _ _ _ _ _ contain an embedded Bluetooth® module.
Output Power: Frequency Range 2402.0 MHz - 2480.0 MHz Output Power 0.001 Watts
Antenna Gain: -0.6 dBi PCB antenna

Industry Canada

Contains IC: **772C-LBZY**
Specification: **RSS210**

Japan

Japanese Radio Law 日本電波法
Type Certification 工事設計認証 R001-P00500

CE See current Declaration of Conformity for full details.

2014/53/EU Radio Equipment Directive (RED)

EN 61010-1:2010	Article 3.1(a) Safety Requirements
EN 61326-1:2013	EMC requirements (Industrial Immunity, Class A Emissions).
EN 301 489-1 V2.1.1	Article 3.1(b)
EN 301 489-17 V3.1.1	Article 3.1(b)
EN 300 328 V1.9.1	Article 3.2 of the R&TTE Directive
EN 300 328 V2.1.1	Additional receiver blocking test to cover requirements for 2014/53/EU

Bluetooth® Declaration ID 38479
Controls are Class A industrial emissions. Not for use in commercial or residential application without further filtering.

Setting Parameters on Watlow Controller

Note: Do not open either control panel while either panel is connected to AC power. Only open panels once all external power has been removed.

- Program the Watlow PM Plus controller
  - Press > arrow to enter menu
  - Press – until “Setup” is selected
  - Press – until “Analog Input”
  - Press > with “Analog Input 1” selected to enter this menu
  - Press > with “Sensor Type” selected to enter this menu
  - Press – or + until “Thermocouple” is selected
  - Press < to return to the previous menu
  - Press – until “TC Linearization” is selected and press > key to enter this menu
  - Press – or + until “K” is selected
  - Repeat these steps for the remaining parameters shown in Table 2
  - Press < several times or press the home button to return to the main screen

Home Key

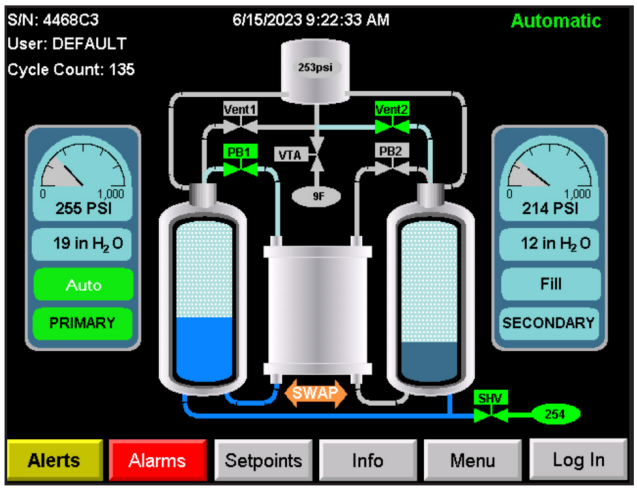
Thermablock Parameters

Parameter	Setpoints for Electric PB Vapori	Parameter Path (Bluetooth)	Watlow PM Plus 6 Parameter Path
Active Set Point	375°F	Main screen	Set Point (home screen)
Sensor Type	Thermocouple	Analog Input 1	Setup > Analog Input 1 > Sensor Type
TC Linearization	K	Analog Input 1	Setup > Analog Input 1 > TC Linearization
Sensor Type	Thermocouple	Analog Input 2	Setup > Analog Input 2 > Sensor Type
TC Linearization	K	Analog Input 2	Setup > Analog Input 2 > TC Linearization
Sides	High	Limit	Setup > Limit > Sides
Maximum Set Point	400°F	Limit	Setup > Limit > Maximum Set Point
High Limit Set Point	400°F	Limit	Setup > Limit > High Limit Set Point
Integrate with System	Yes	Limit	Setup > Limit > Integrate w/ System
Heat Algorithm	On/Off	Control Loop	Setup > Control Loop > Heat Algorithm
On/Off Heat Hysteresis	5°F	Control Loop	Setup > Control Loop > On/Off Heat Hyster.
Minimum Set Point	0°F	Control Loop	Setup > Control Loop > Minimum Set Point
Maximum Set Point	350°F	Control Loop	Setup > Control Loop > Maximum Set Point
Function	Heat**	Output 1	Setup > Output > Output 1 > Function
Function Instance	1**	Output 1	N/A
Alarm 1 Type	Off	Alarm 1	Setup > Alarm > Alarm 1 > Type
Alarm 1 Source	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Alarm Source
Alarm Source Instance	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Alarm Source Instance
Alarm 1 Logic	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Logic
Alarm 1 Sides	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Sides
Alarm 1 Low Set Point	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Low Set Point
Alarm 1 Latching	N/A	Alarm 1	Setup > Alarm > Alarm 1 > Latching

**Default value *See page 96 of EZ-ZONE PM User's Guide for Integrated Controller Models for details (document 0600-0059-0000 rev P)

HMI Screens

MAIN Screen



Serial Number field — Displays Serial Number of Unit when logged in as user other than default

User field — Shows current logged in user

Auto/Manual field — Displays if the Trifecta is in Auto or Manual mode

Status field — Displays the status of the Trifecta when in Auto

- Run/Fill — Secondary tank is filling
- Run/PB Hold — Secondary tank is building pressure
- Run/Ready — Secondary tank is ready to be used
- Run/Assist — Secondary tank is being called for assist

Date & Time field — Displays current date and time

Bulk Tank field — Displays the pressure of the liquid coming from the bulk tank

Pressure gauges — Shows pressure of tanks 1 and 2

Level gauges — Displays the level of tanks 1 and 2 Primary tank's level is shown in blue

Vent Temperature field — Displays the temperature at Trifecta's vent to atmosphere

Valve indicators — Displays the status of Trifecta's five valves Green indicates the valve is open

Cycle Count field — Displays the number of cycles the Trifecta has had Users may tap on the Cycle Count to open RESET COUNTS popup

Force Tank Switch - Here you are able to swap which tank is primary and secondary

Primary/Secondary fields — Displays which tank is presently the Primary tank and which is the Secondary

Alerts/Alarms button — Displays ALERTS and ALARMS screens, respectively

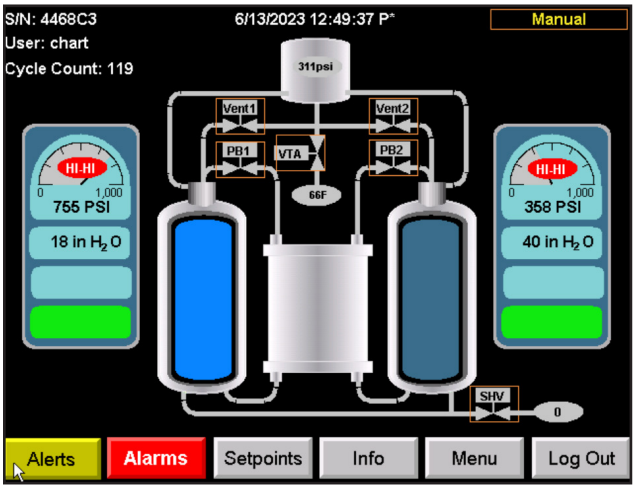
Setpoints — Brings user to Setpoints popup

Info button — Displays the INFO popup

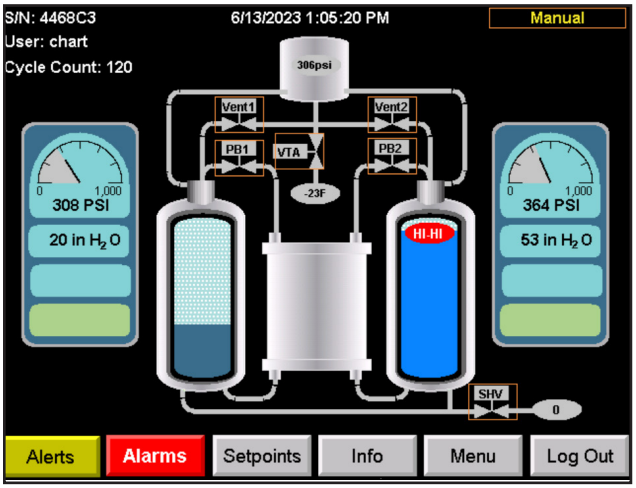
Menu — Displays the SCREEN NAVIGATION popup

Login/Logout — Displays the Login popup is logged in as default Logs out the current user if logged in as user other than default

HIGH/HIGH-HIGH ALARM Screen



High/High High-Pressure popups — Display that a High (tank overpressure) or High-High (Pressure transmitter fault)



has occurred

High High-Level popups — displays that a High-High Level (Level transmitter fault) has occurred

ALERT Screen

Date & Time field — Displays current date and time
Alert Table

- **Trigger Column** – Displays label of Alert
- **Qty** – Displays number of times Alert has been triggered since Time Last Reset
- **Acc Time** – Displays Accumulated time of Alert since Time Last Reset
- **Message** – Description of Alert

Note: Selected Alert is shown with a blue background and white text

Time Last Reset — Date and Time of last Reset Status

Silence Alarms button — Stops strobe light on control panel from flashing if currently flashing. Will also silence any alarms running to the customer facility from customer alarm relay

Reset Status — Resets Quantity count and Accumulation Time of each Alert and Alarm trigger

Home — Jumps to first Active Alert

End — Jumps to last Active Alert

Page Up — Moves up 1 page of Active Alerts

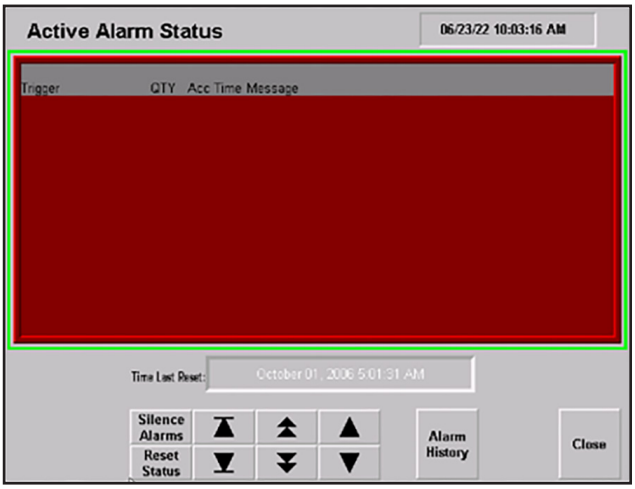
Page Down — Moves down 1 page of Active Alerts

Move Up — Scrolls up Active Alerts

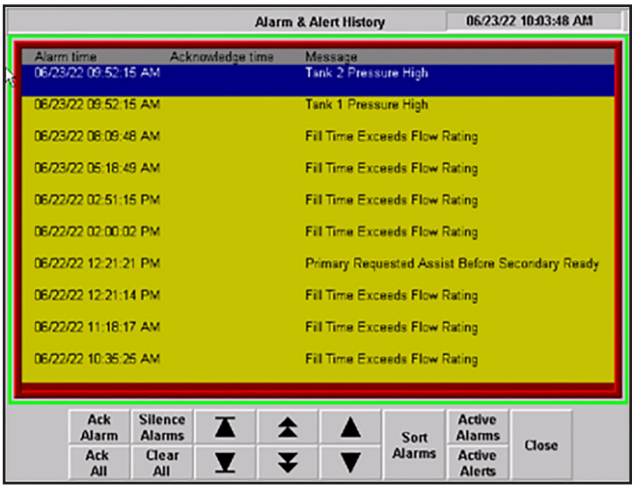
Move Down — Scrolls down Active Alerts

Alarm History — Opens the ALARM & ALERT HISTORY Screen

Close — Returns to MAIN Screen



ALARM Screen



Displays the Active Alarms (Shutdown Alarms)

& ALERT HISTORY Screen

Displays the history of Alarms and Alerts

Note: Alerts are shown with a yellow background and black text. Alarms are shown with a red background and white text. Selected Alarm/Alert is shown with a blue background and white text.

Ack Alarm button — Acknowledges selected Alarm/Alert

Ack All — Acknowledges all Alarms and Alerts

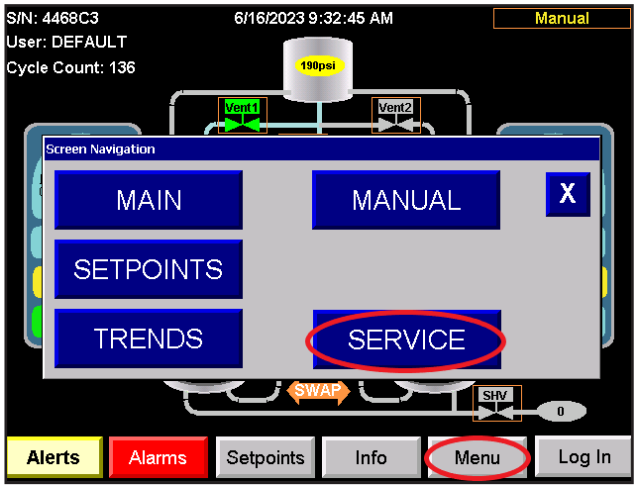
Clear All — Clears all Alarms and Alerts from History

Sort Alarms — Sorts the history by time or by trigger

Active Alerts — Displays the ACTIVE ALERTS screen

Active Alarms — Displays the ACTIVE ALARMS screen

RESET COUNTS Popup



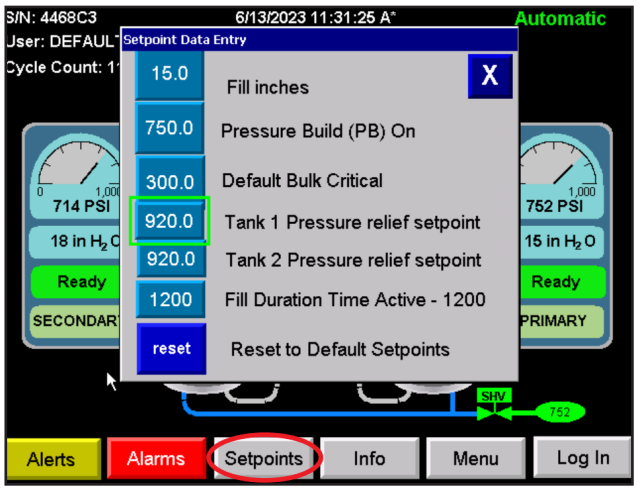
Current Cycle Time field — Amount of time for the current cycle

Prev. Cycle Time — Amount of time for previous cycle

Cycle Count — Number of cycles Trifecta has had since last reset

Reset — Resets cycle count to 0. A non-resettable counter can be found on a password protected screen.

SETPOINT DATA ENTRY Popup



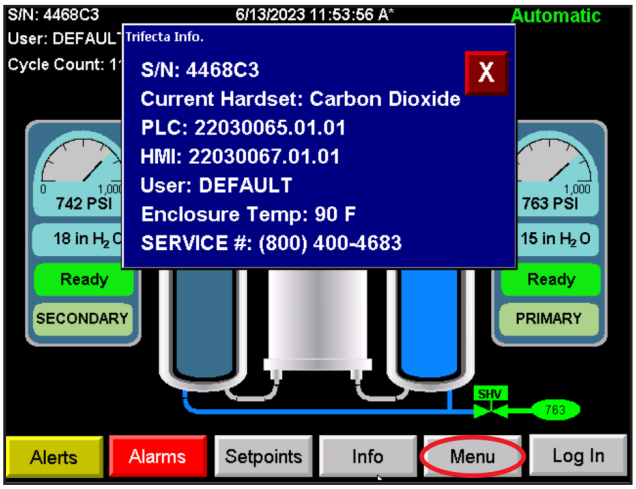
Fill Inches field — The level to fill tanks to

Pressure Build (PB) On — The pressure at which to begin Pressure Build on Primary Tank

Default Bulk Critical — Displays Bulk Tank Pressure at which Trifecta will only vent to atmosphere

Reset — Resets setpoints to default settings

INFO Popup



PLC Rev field — Revision of PLC Program running on unit

HMI Rev — Revision of HMI Program running on Trifecta

Trifecta Service # — Chart Customer Service phone number

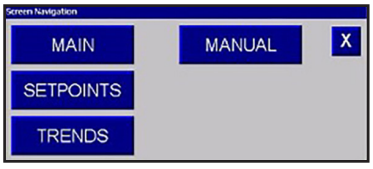
Serial Number — Serial number of the Trifecta

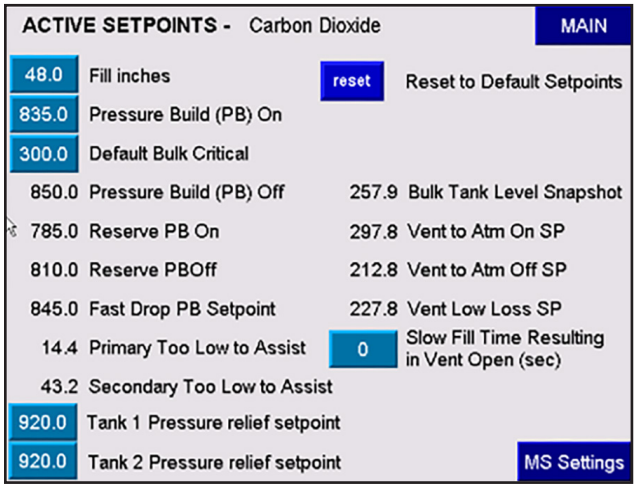
Current PLC Program — Current recipe running on the Trifecta PLC

User — User currently logged into unit

Enclosure Temp — Temperature inside of the Control Panel

SCREEN MENU NAVIGATION Popup





ACTIVE SETPOINT Screen

Pressure Build (PB) Off field — The pressure at which Pressure Build will stop

Reserve PB On — The pressure at which to begin PB on Secondary Tank if not assisting

Reserve PB Off — The pressure at which PB of Secondary Tank will stop

Fast Drop PB Setpoint — The pressure at which to begin Pressure Build if Pressure is dropping fast

Primary Too Low to get an assist — The level at which the primary tank will automatically switch to the secondary tank (low level value is programmed into the hard sets of the PLC)

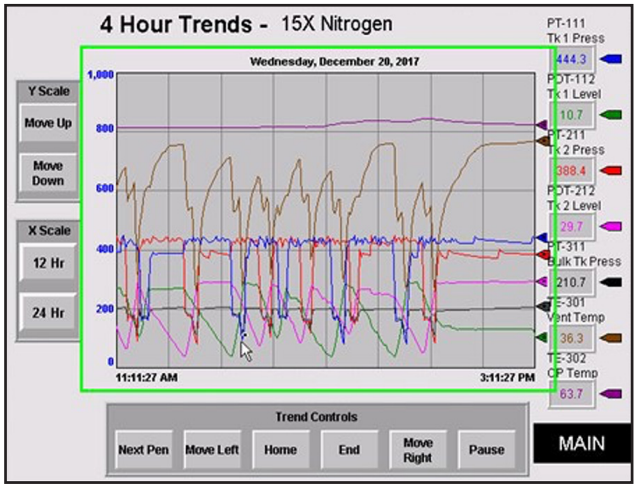
Secondary Too Low to Assist — The level at which the Secondary Tank is too low to assist the primary tank (90% of the current liquid level setpoint) and a primary tank switch will occur

Bulk Tank Level Snapshot — The point at which the PLC takes a snapshot of the bulk tank pressure to determine when to turn on and off the vent to atmosphere during the filling process

Vent to ATM on SP (initial depressurization) — The pressure at which a Secondary Tank will begin Vent to Atmosphere if it rises above

Vent to ATM Off SP (while filling) — The pressure at which a Secondary Tank will stop Venting to Atmosphere if it drops below

Vent Low Loss SP (while filling) — The pressure at which a Secondary Tank will resume Venting to Atmosphere if it rises above



TREND Screen

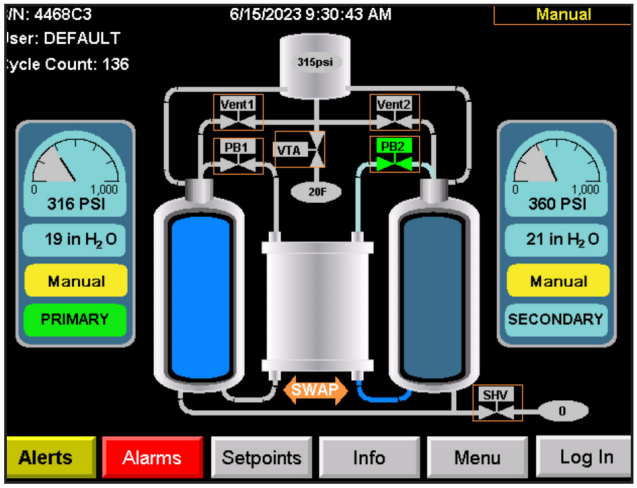
Tk1 Press field — Pressure of Tank 1 in psig

Tk1 Level — Level of Tank 1 in H2O Tk2 Press — Pressure of Tank 2 in psig Tk2 Level — Level of Tank 2 in H2O

Bulk Tk Press — Pressure of the Bulk Tank in psig Vent Temp — Temperature at the vent in °F

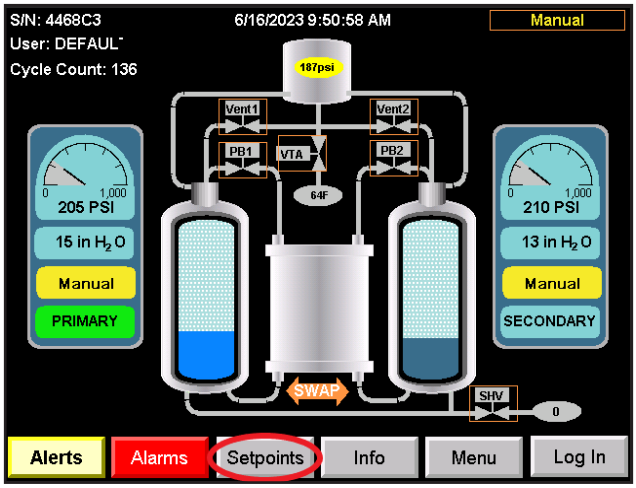
CP Temp — Temperature in the Control Panel in °F Next Pen — Toggles Active Pen

MANUAL CONTROL Screen



When system is in “manual,” the operator can manually open each actuated valve by touching the valve.. This screen can also be used to force a tank switch.

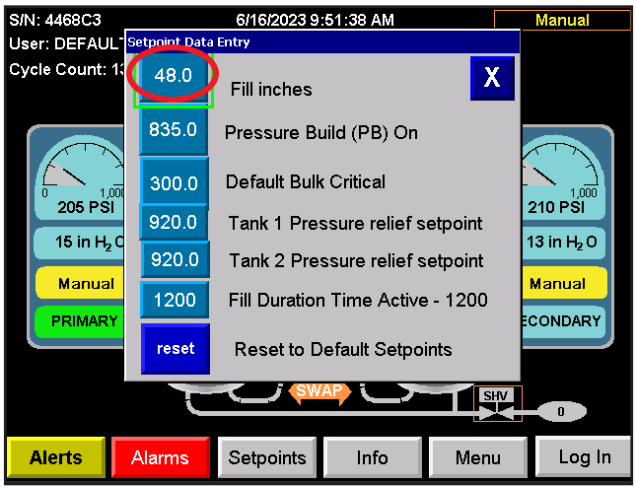
Parameter Settings



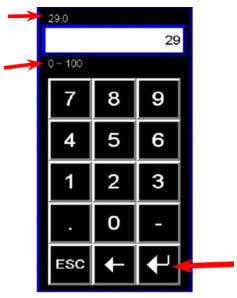
Six settable parameters are accessible from the HMI "Setpoints" button. These parameters are key to setting all parameters. To get the adjustable setpoints, the "Setpoints" button will bring up the "Setpoint Data Entry" popup menu. Here you can adjust the Fill inches, Pressure Build On and the Bulk Critical.

Fill Setpoint

Pressing of "Fill inches" button will bring up another popup window.



Here you can enter a new value and press enter to save it



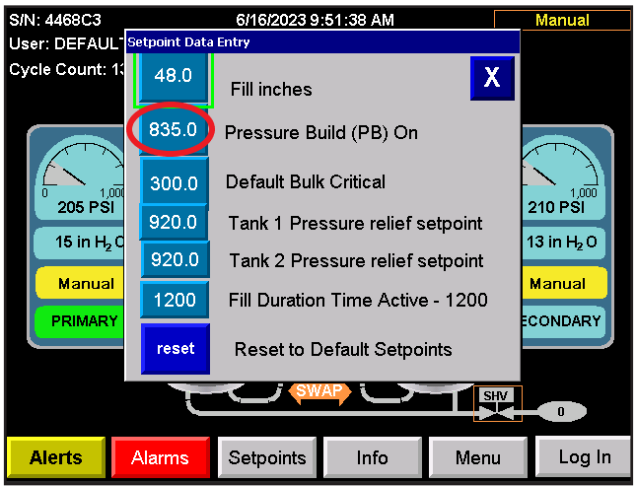
Current setting

Range setting

Pressure Build Setpoint

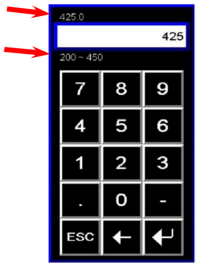
Pressing of the "Pressure Build" button will bring up another popup window.

Here you can enter a new value and press enter to save it.



Current setting Range setting

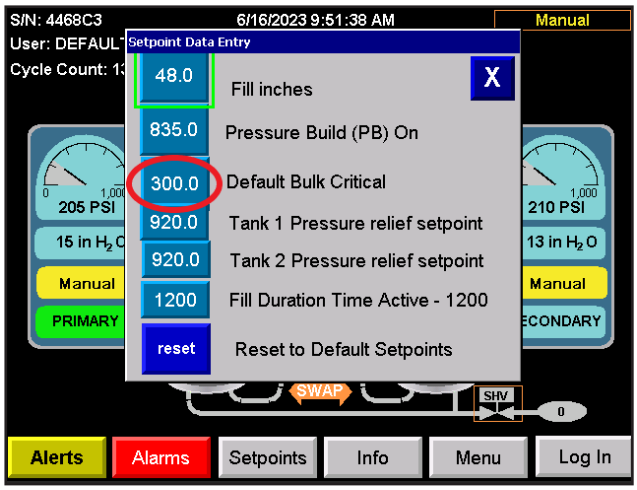
Bulk Critical Setpoint

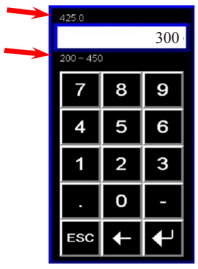


Note: Since the tanks are warm upon initial installation, they may vent for several minutes before they are cold enough to accumulate liquid.

Note: "PB OFF" setpoint will be automatically set to 15 psig above the "PB ON" setpoint.

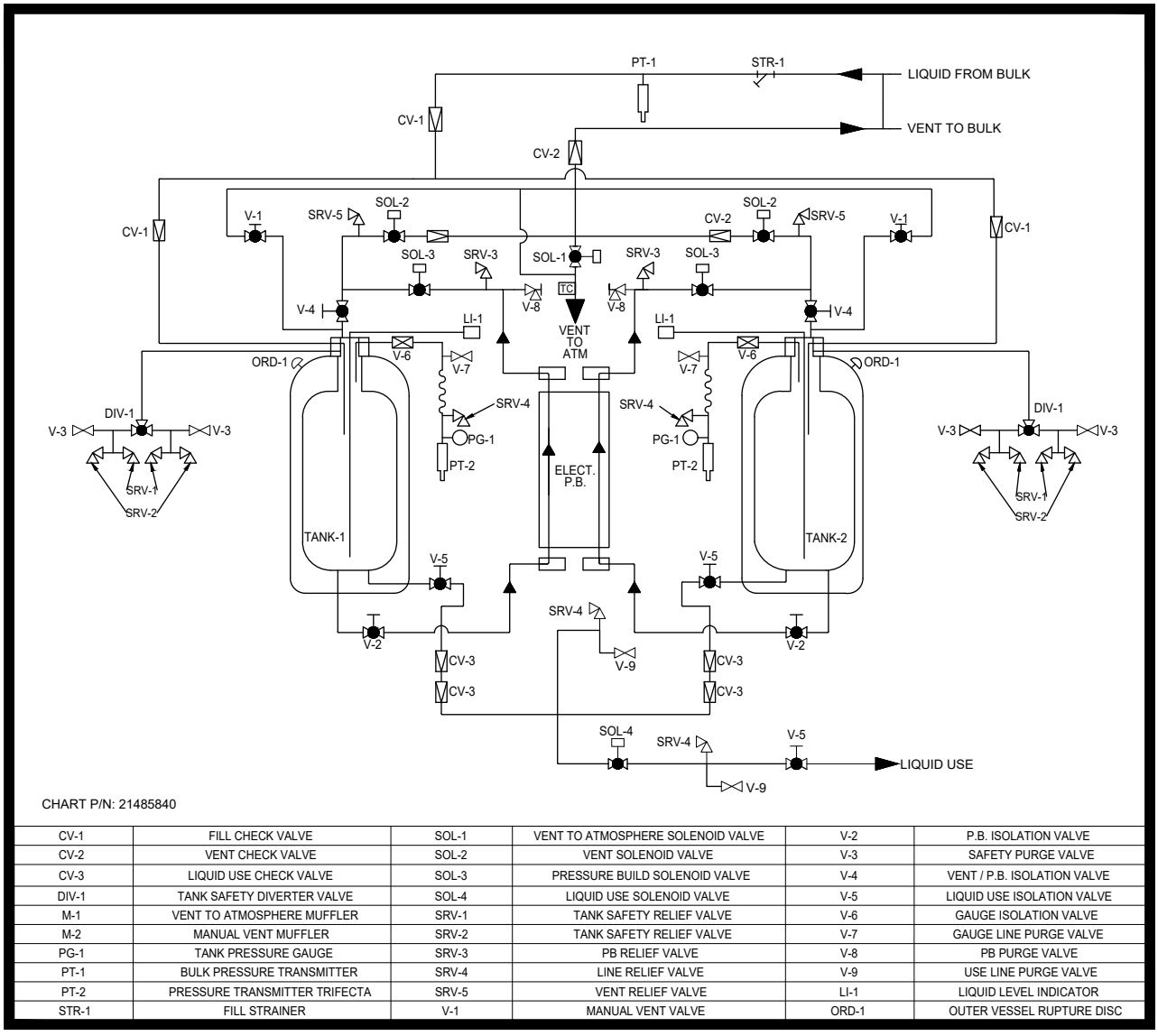
Pressing of the “Bulk Critical” button will bring up another popup window.





Operation Details

The Trifecta Pro CO_2 logic keys on pressure instead of liquid level. The components have been minimized (reduced) yet the design has duplication of key components.



CV-1	FILL CHECK VALVE	SOL-1	VENT TO ATMOSPHERE SOLENOID VALVE	V-2	P.B. ISOLATION VALVE
CV-2	VENT CHECK VALVE	SOL-2	VENT SOLENOID VALVE	V-3	SAFETY PURGE VALVE
CV-3	LIQUID USE CHECK VALVE	SOL-3	PRESSURE BUILD SOLENOID VALVE	V-4	VENT / P.B. ISOLATION VALVE
DIV-1	TANK SAFETY DIVERTER VALVE	SOL-4	LIQUID USE SOLENOID VALVE	V-5	LIQUID USE ISOLATION VALVE
M-1	VENT TO ATMOSPHERE MUFFLER	SRV-1	TANK SAFETY RELIEF VALVE	V-6	GAUGE ISOLATION VALVE
M-2	MANUAL VENT MUFFLER	SRV-2	TANK SAFETY RELIEF VALVE	V-7	GAUGE LINE PURGE VALVE
PG-1	TANK PRESSURE GAUGE	SRV-3	PB RELIEF VALVE	V-8	PB PURGE VALVE
PT-1	BULK PRESSURE TRANSMITTER	SRV-4	LINE RELIEF VALVE	V-9	USE LINE PURGE VALVE
PT-2	PRESSURE TRANSMITTER TRIFECTA	SRV-5	VENT RELIEF VALVE	LI-1	LIQUID LEVEL INDICATOR
STR-1	FILL STRAINER	V-1	MANUAL VENT VALVE	ORD-1	OUTER VESSEL RUPTURE DISC

Figure 2 - Schematic

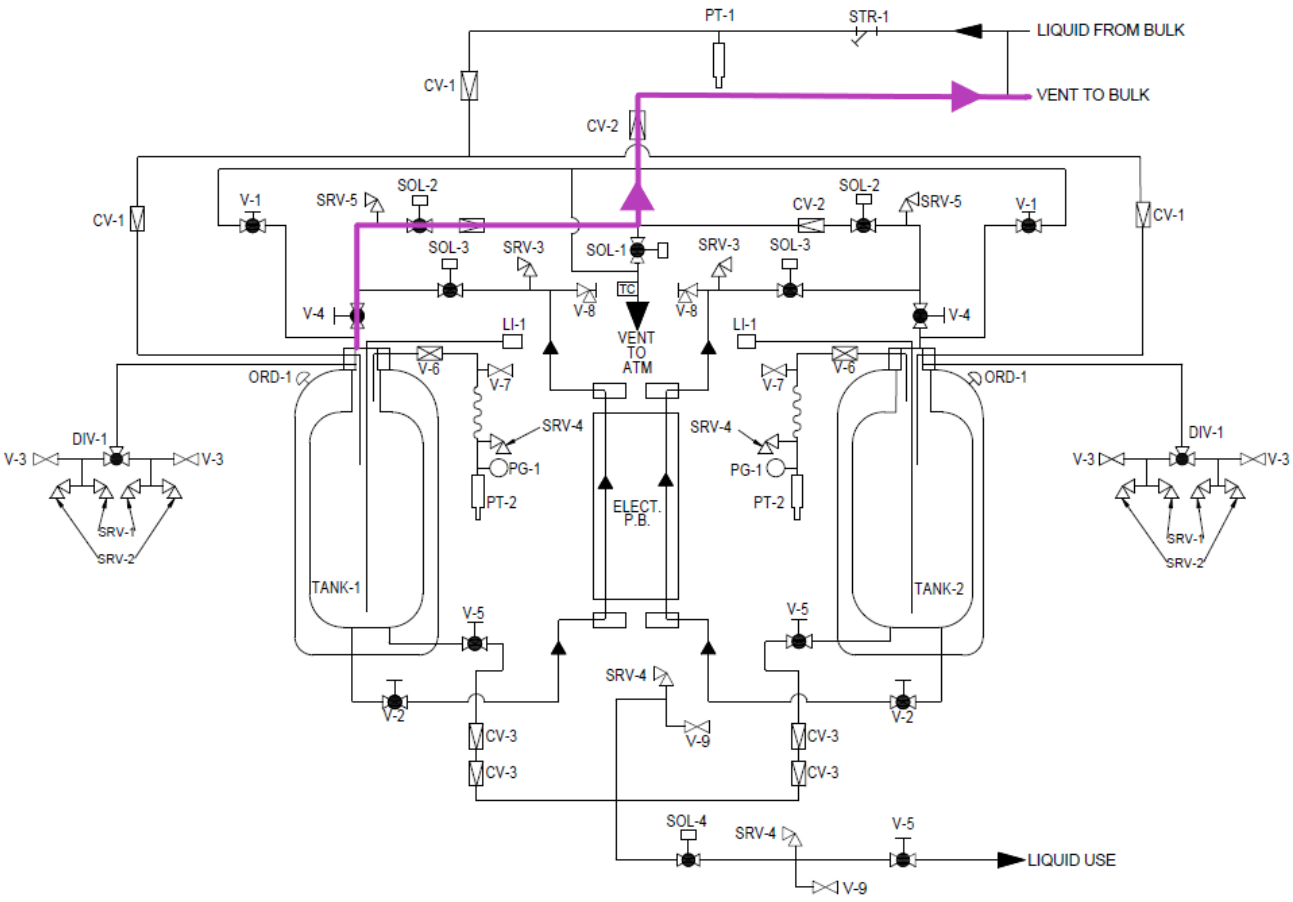
There are four main operational Modes:

- Filling
- Pressure Building
- Primary Assist
- Primary Tank Switch

These modes along with the parameter settings determine the operation of the system.

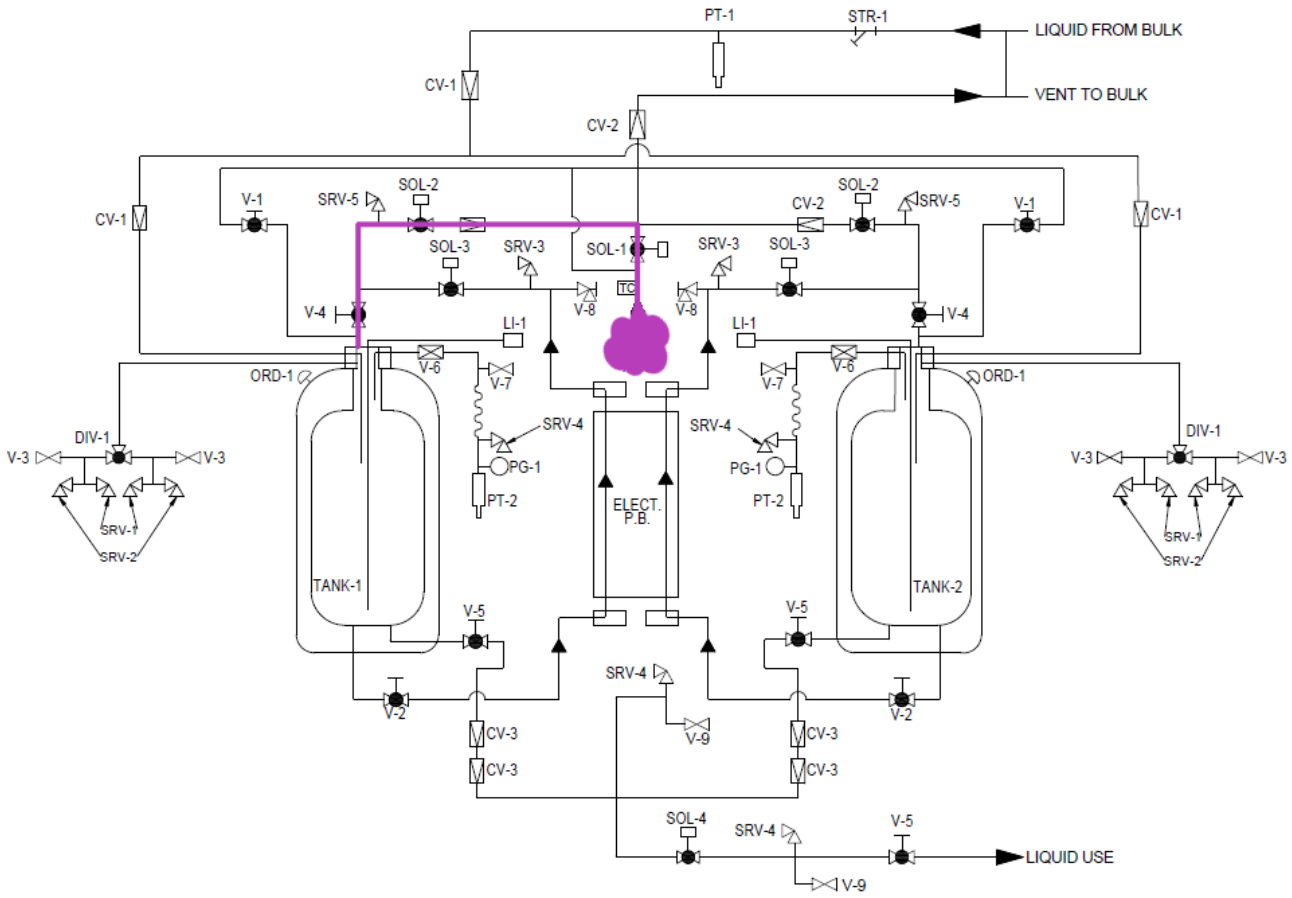
Filling Mode – Vent to Storage

Filling Secondary
When the primary tank can't maintain pressure, the primary tank low or the secondary tank is too low to assist the system initiates a fill by switching the secondary tank to primary and then opens the vent valve which directs the high pressure gas into the bulk tank though the liquid line.
(1 of 6)



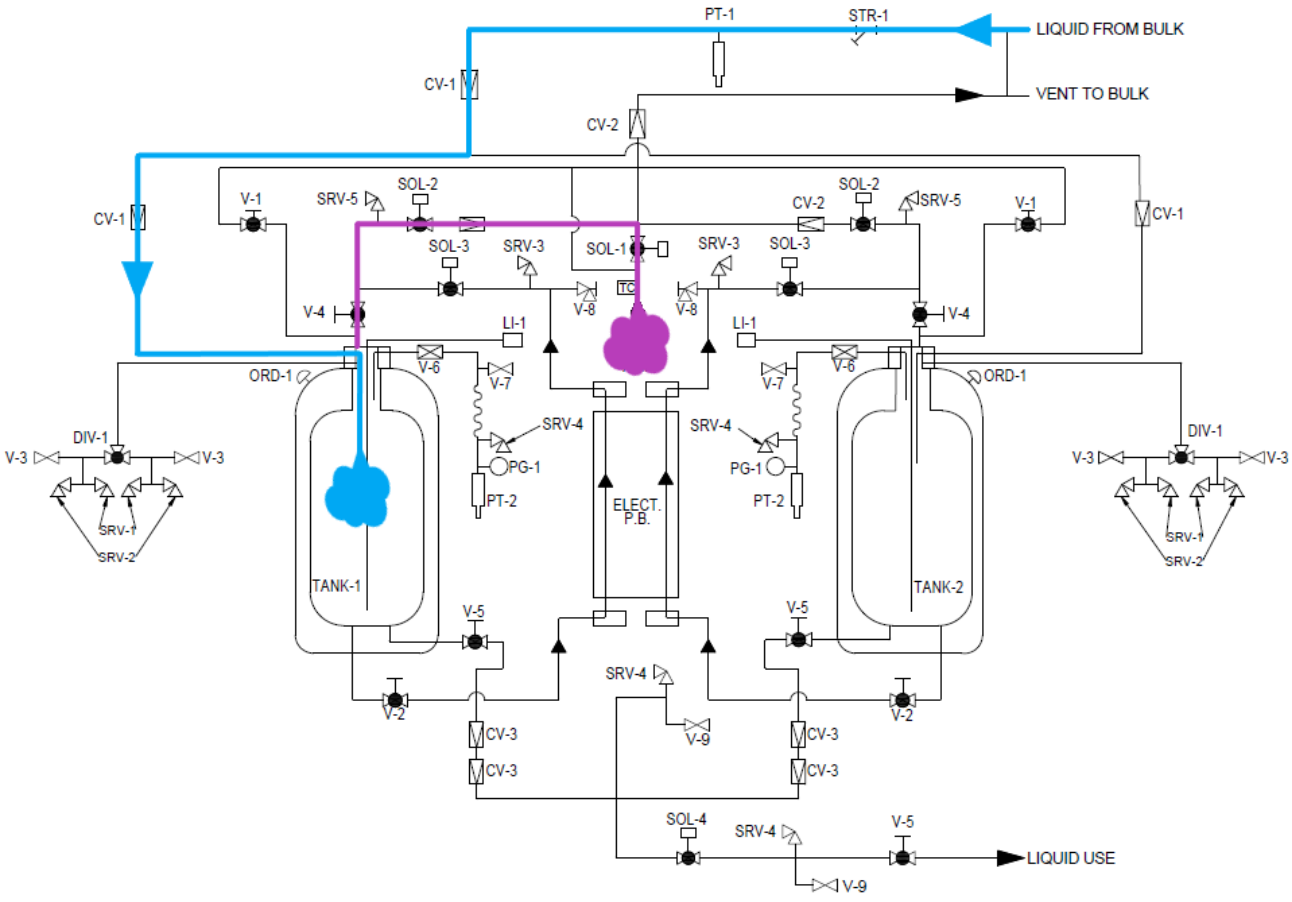
Filling Mode – Vent to Atmosphere

Filling Secondary
When the receiving tank is 40 psi above bulk tank pressure, the Vent to atmosphere valve opens.
(2 of 6)



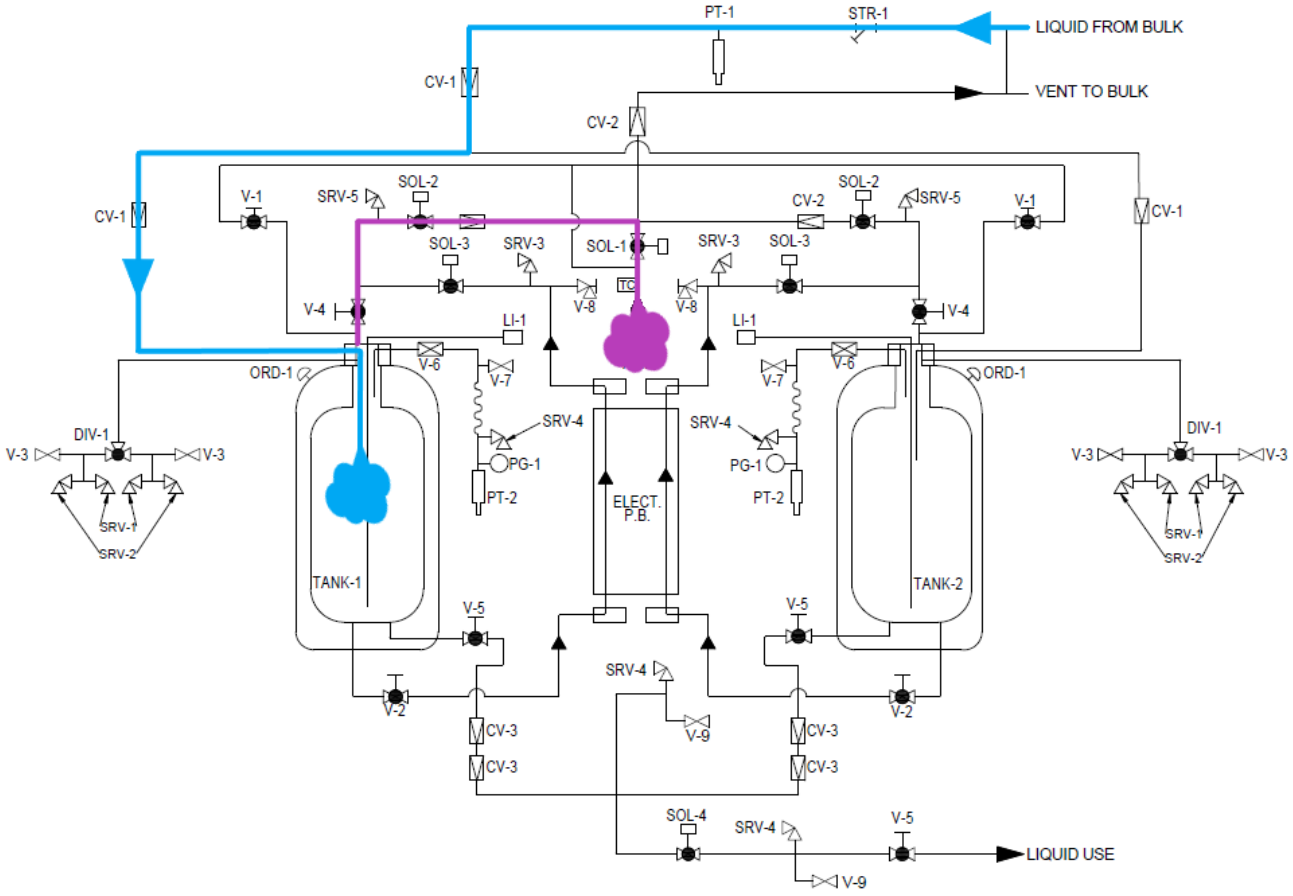
Filling Mode – Liquid Flow

Filling Secondary
When the receiving tank drops below the bulk tank pressure, liquid flows from the bulk tank to the receiving tank.
(3 of 6)



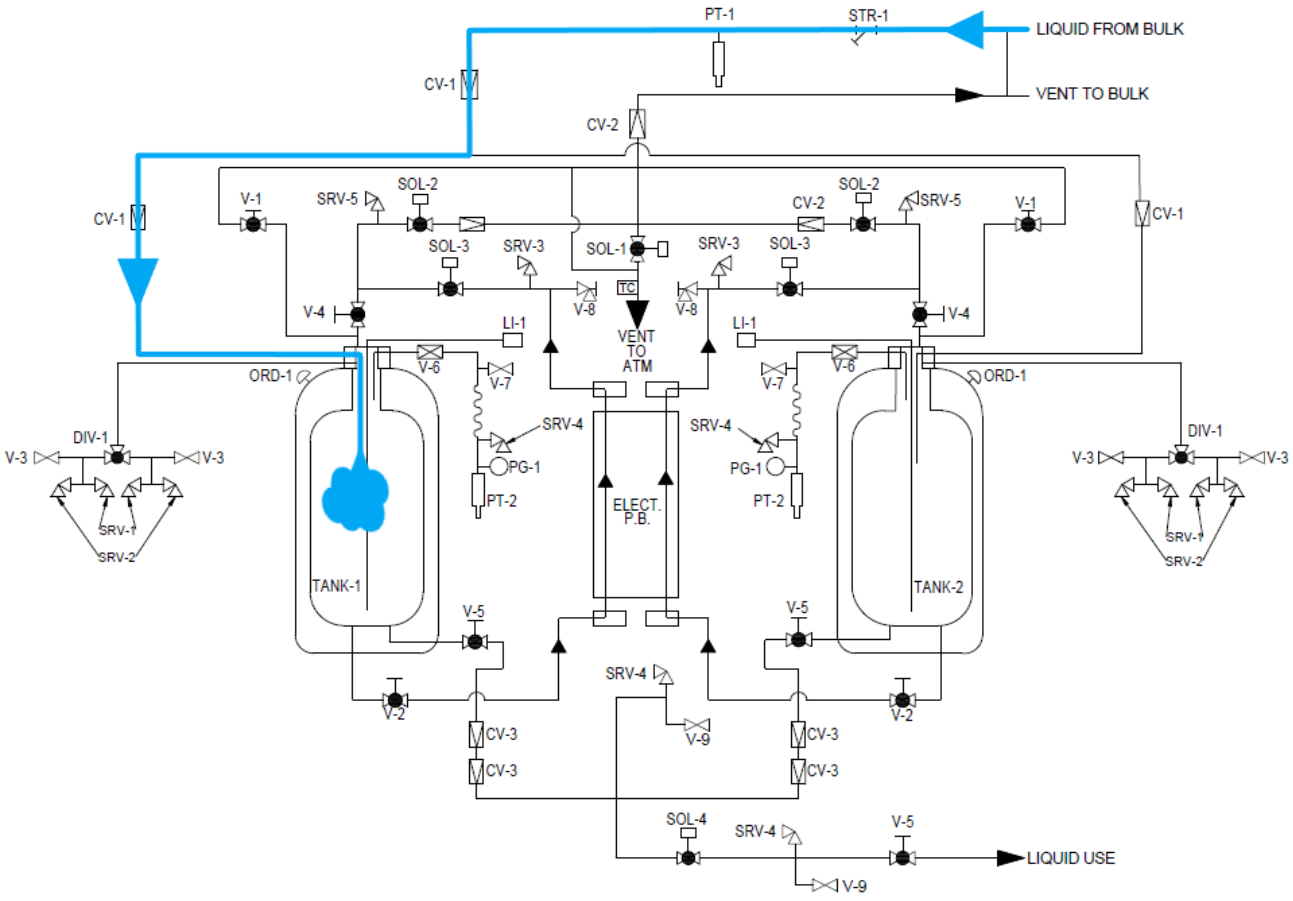
Filling Mode – Low Loss Vento to Atmosphere

Filling Secondary
When the receiving tank pressure builds to bulk pressure - 30 psi the vent to atmosphere valve re-opens. Also, if the fill time exceeds the vent to atmosphere forced on time the system will "Fast Fill" opening the vent to atmosphere valve until the tank is full.
(4 of 6)



Filling Mode – Low Loss

Filling Secondary
When the receiving tank pressure reaches bulk pressure - 45 psi the vent to atmosphere valve closes. This is sometimes referred to as the "Low Loss" fill mode.
(5 of 6)

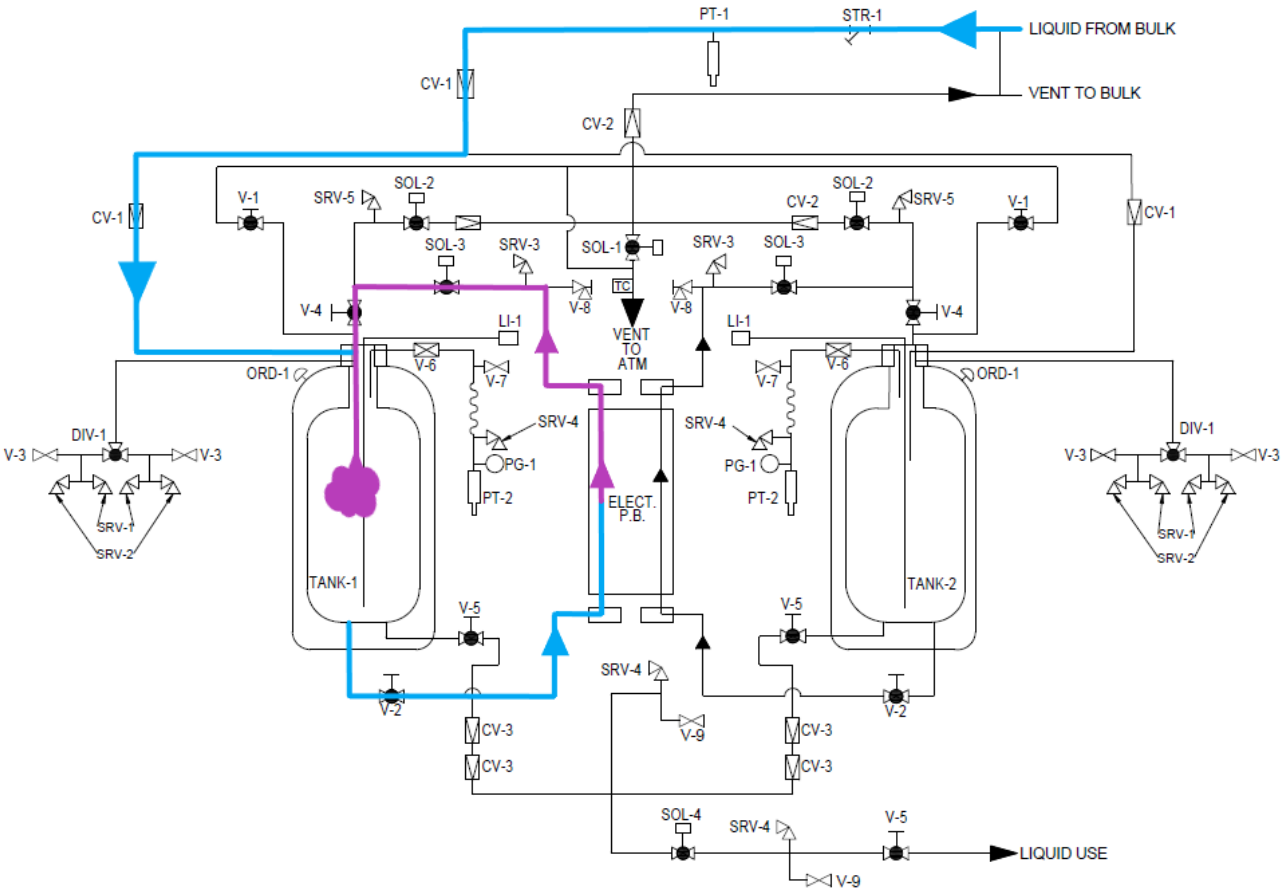


Fill Termination – Primary Pressure Build On

Filling Secondary

When the system determines that the receiving (secondary) tank is full the pressure building valve opens. The pressure rise caused by the PB circuit will stop the flow of liquid from the bulk tank when the pressure rises above the bulk tank pressure.

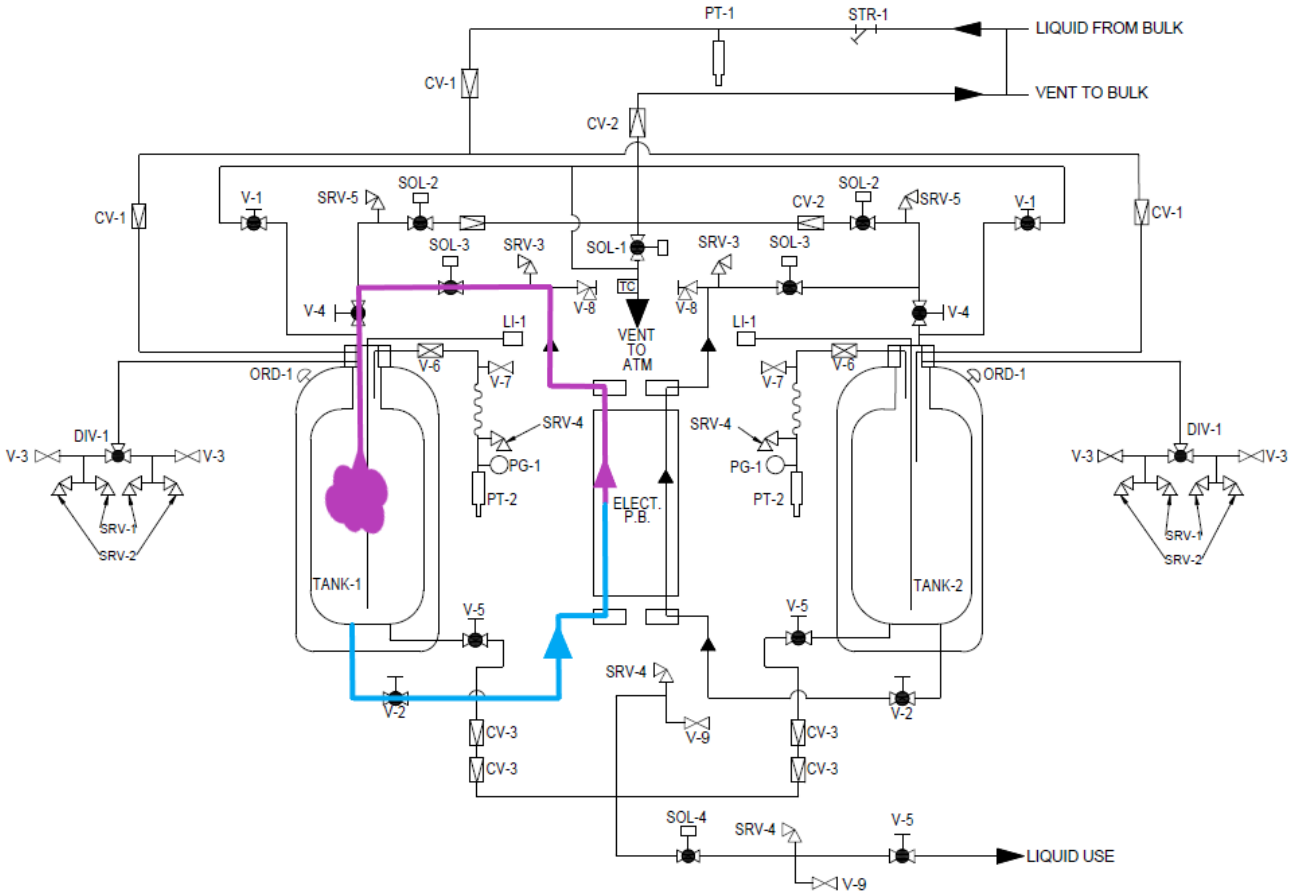
(6 of 6)



Initial Pressure Build After Fill

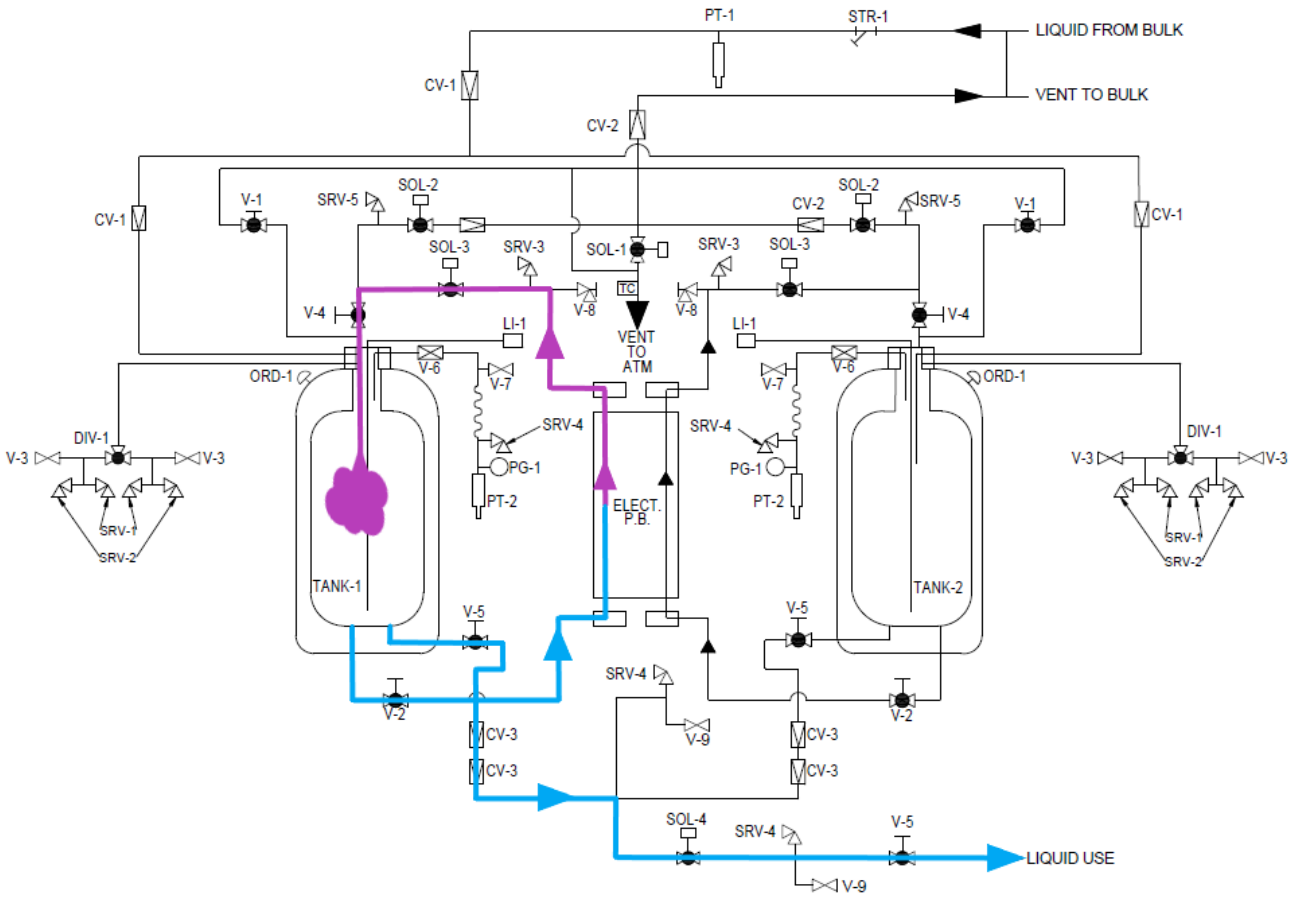
Initial Pressure Build

The secondary tank builds to a "Hold" pressure just below the operating pressure. The "Hold PB Off" is 25 psi below the primary PB On pressure. The "Hold PB On" is 50 psi below the primary PB On pressure.



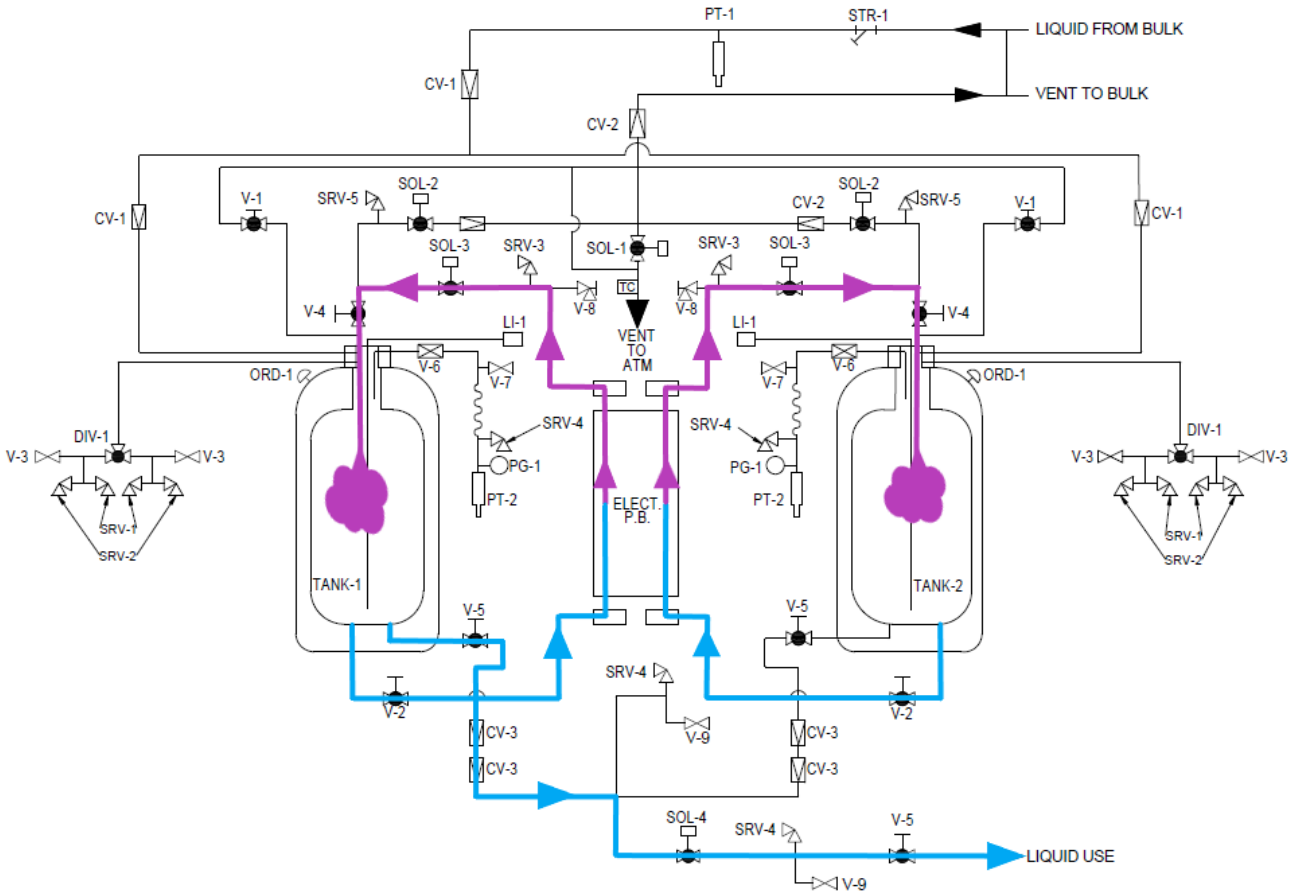
Primary Pressure Build On

Primary PB On
The primary tank builds pressure by opening the Pressure Building valve at the "PB On" set point. This parameter is settable through the keys and display of the PLC. Liquid flows to the use due to the higher pressure in the primary tank.



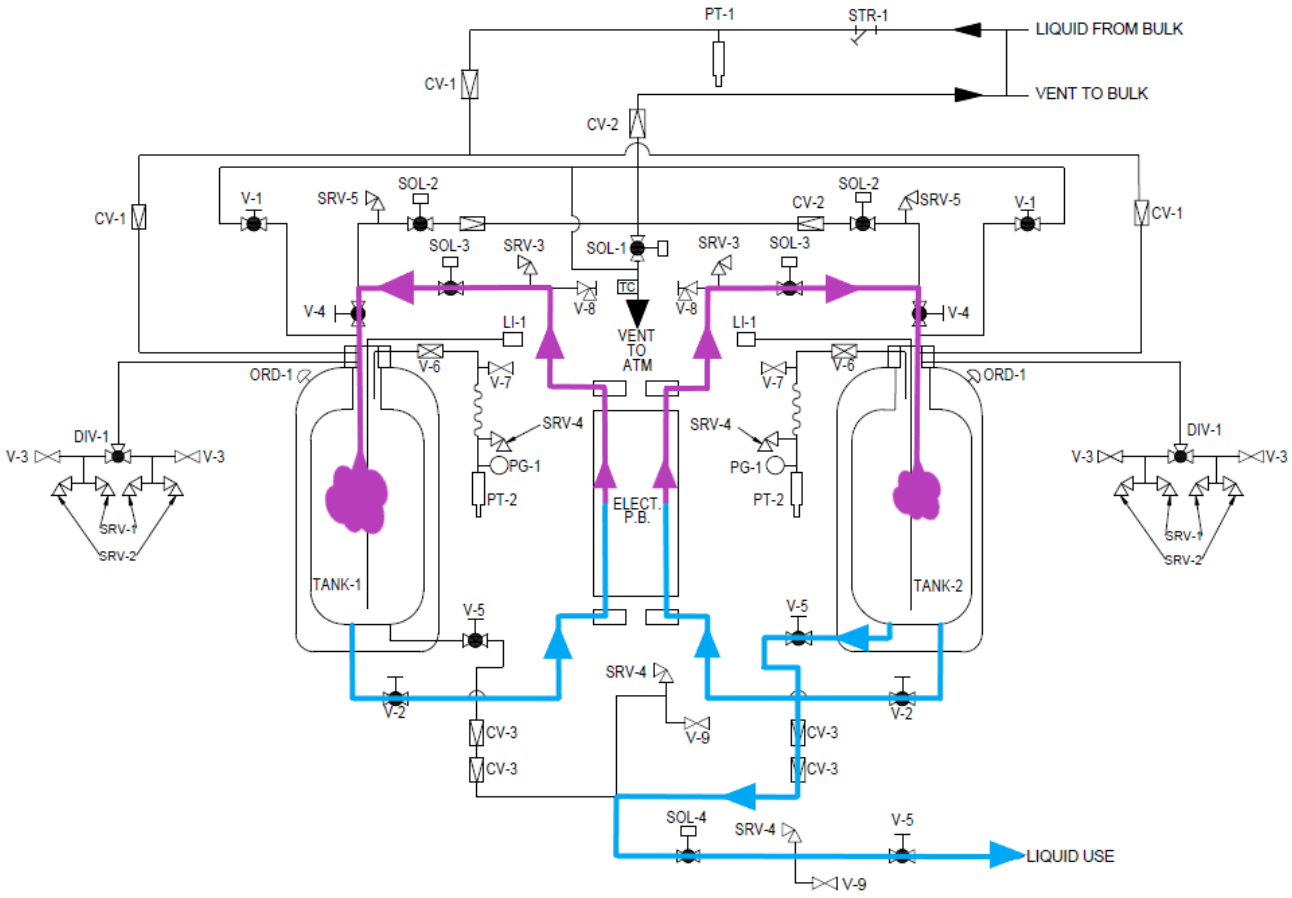
Call for Assist

Assist
When the primary tank pressure drops below the "PB On" set point for 10 seconds, the secondary tank is full and at the reserve pressure. The primary side calls for a pressure assist from the secondary side. The secondary tank's pressure building valve turns on.
(1 of 3)



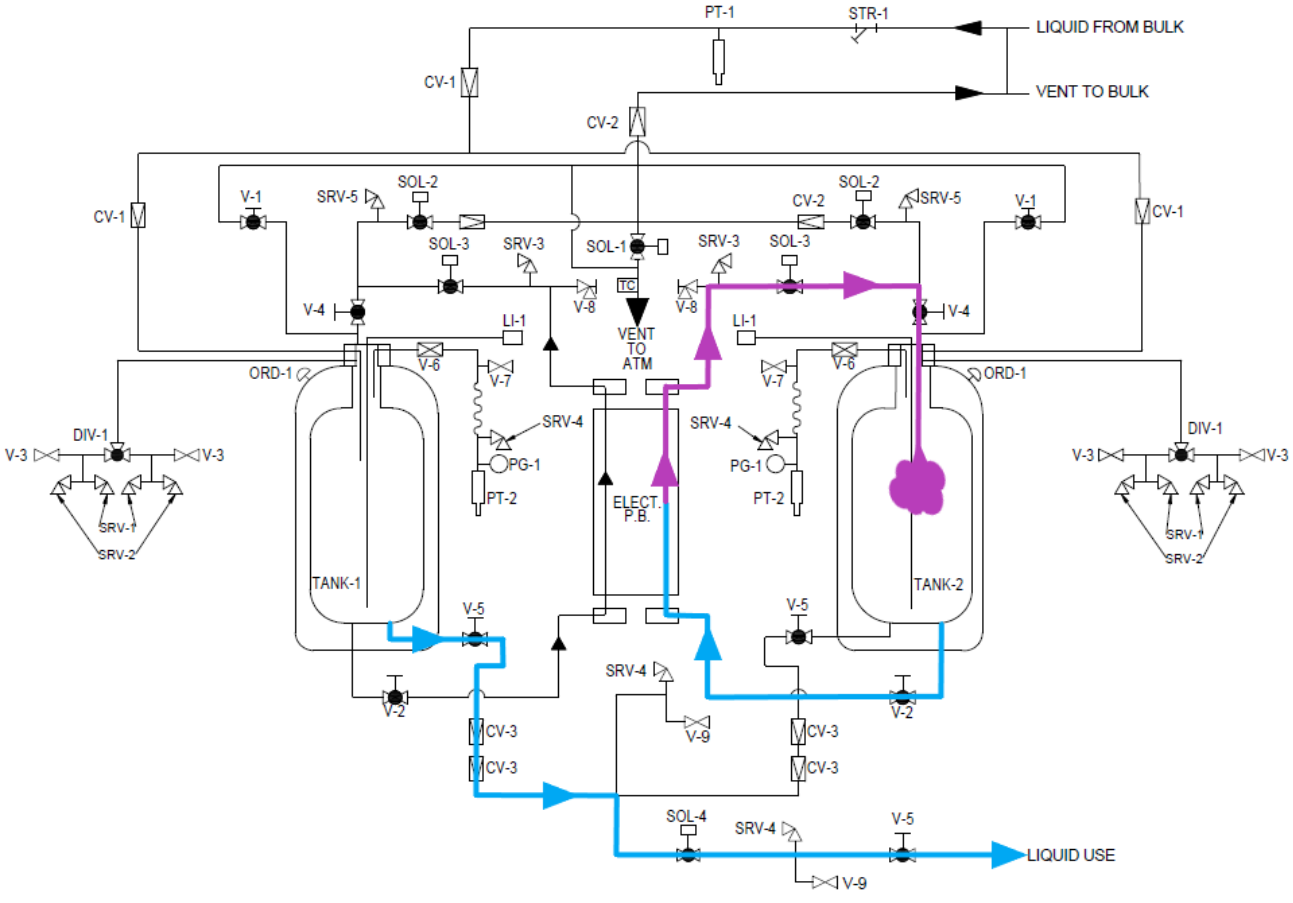
Secondary Assist of Primary

Assist
When the secondary tanks pressures exceed the primary tanks pressures flow switches to the secondary tank. While the secondary tank is supplying liquid to the use the primary tank pressure is recovering.
(2 of 3)



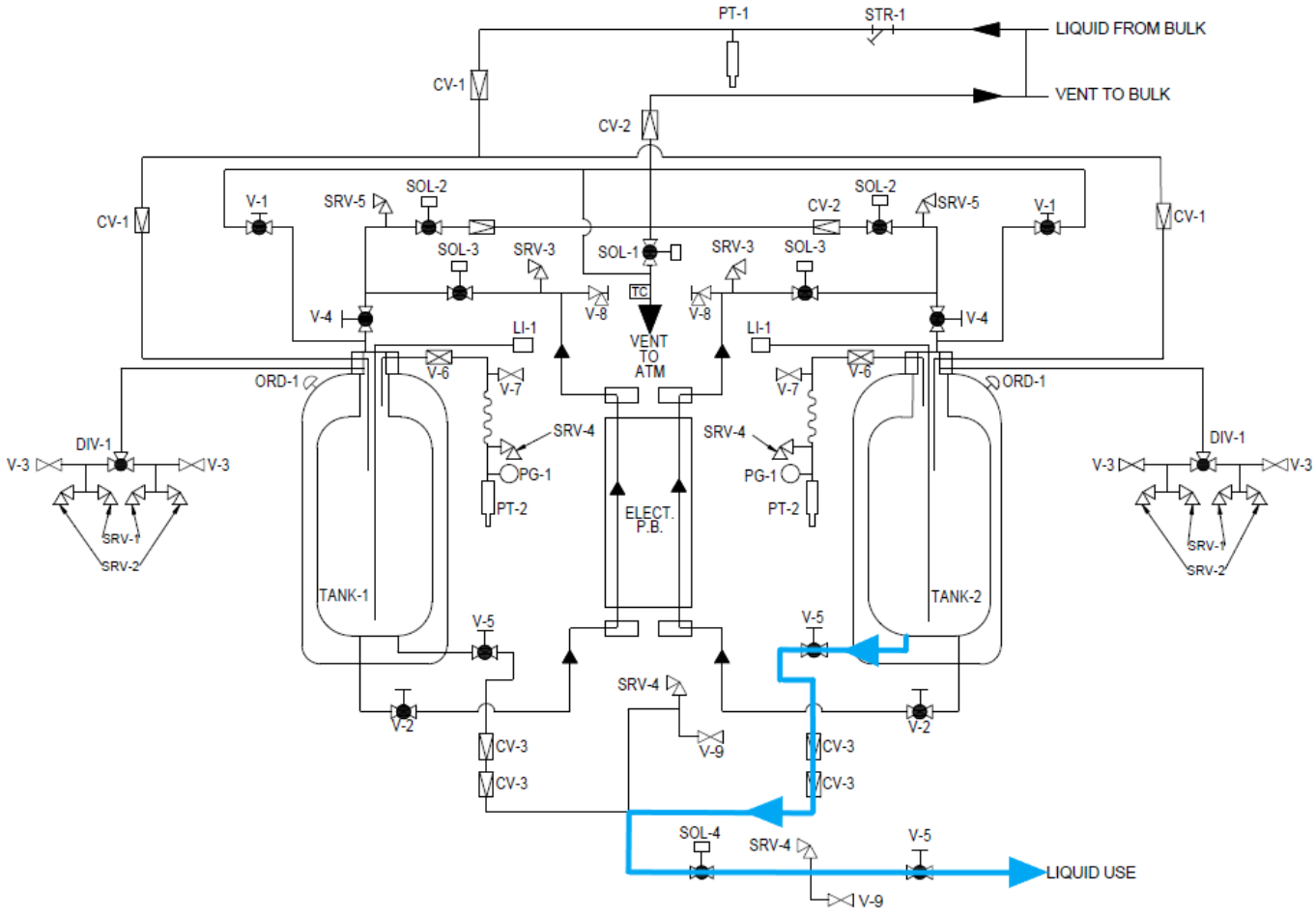
Assist Complete - Primary Recovered

Assist
When the secondary tank reaches the "PB Off" set point the mode switches back to "ready". Then the secondary tank flow and operation will resume from the primary tank.
(3 of 3)



Primary Unable to Recover – Switch Primary Side

Tank Switch
A primary tank switch occurs when the assisting tanks reaches "PB Off" pressure before the Primary tank recovers to the "PB On" pressure



Tanks Switch

A Primary Tank Switch will occur under the following conditions:

- If the assist tank reaches PB Off pressure before the primary tank recovers to the PB On pressure.
- If the primary tank reaches a Too Low to be Assisted level (30% of fill level).
- If the secondary tank reaches a Too Low to Assist level (90% of fill level).

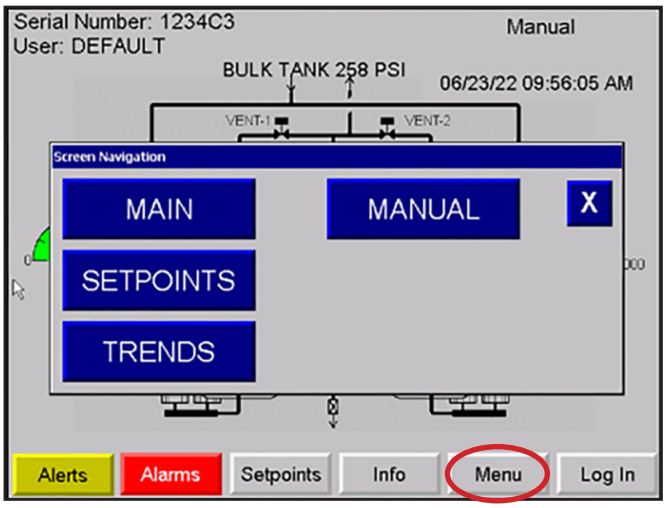
Service

Alerts & Alarms

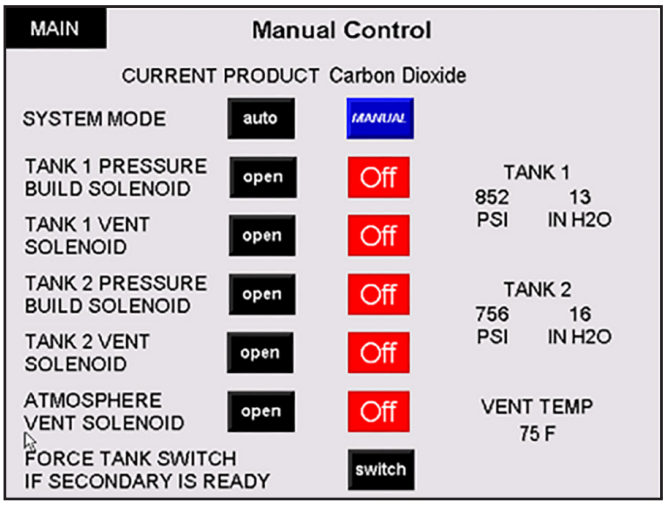
Code	Description	Action
ALERTS	Vent Temperature Alarm	Tank Overfill, liquid detected at vent outlet
ALERTS	Tank 1 Pressure High	Overpressure Condition
ALERTS	Tank 2 Pressure High	Overpressure Condition
ALERTS	Primary Tank Flow High	Instantaneous flowrates exceeding rating of unit
ALERTS	Fill Time Exceeds Flow Rating	Fill time is too slow to keep up with max flows
ALERTS	Primary Requested Assist Before Secondary Ready	Pressure in primary dropped below “PB ON” for 10 sec. Secondary not ready to assist.
ALERTS	Cycles Exceed Service Setting	Service Required (20,000 cycles)
ALERTS	Primary Press Less Than Secondary PB ON	When in Modes 0 or 2, Primary tank has fallen below secondary’s PB on Setpoint.
ALERTS	Primary & Secondary Press Low Alert	Both Primary & Secondary have been pressure building for 10 Min. (in Auto)
ALERTS	Primary Pressure Less Than PB ON 10 seconds	Primary Pressure has dropped below PB ON for 10 sec. (Disabled)
ALERTS	Bulk Tank Low Pressure	When Bulk Tank Pressure falls below 200 PSI.
ALARMS	Tank 1 Pressure Transmitter Out of Range High	Transmitter error
ALARMS	Tank 1 Pressure Transmitter Out of Range Low	Transmitter error
ALARMS	Tank 2 Pressure Transmitter Out of Range High	Transmitter error
ALARMS	Tank 2 Pressure Transmitter Out of Range Low	Transmitter error
ALARMS	Bulk Tank Pressure Transmitter Out of Range High	Transmitter error
ALARMS	Bulk Tank Pressure Transmitter Out of Range Low	Transmitter error
ALARMS	Tank 1 Level Sensor Out of Range High	Transmitter error
ALARMS	Tank 1 Level Sensor Out of Range Low	Transmitter error
ALARMS	Tank 2 Level Sensor Out of Range High	Transmitter error
ALARMS	Tank 2 Level Sensor Out of Range Low	Transmitter error
ALARMS	Low-Low Pressure	When Tank pressure falls below 125 PSI. The system will go into manual and shut off the Liquid Use Valve.

Manually Operating the Valves

From the Main Screen, you need to press “Menu” on the screen, this will bring up a pop-up box.

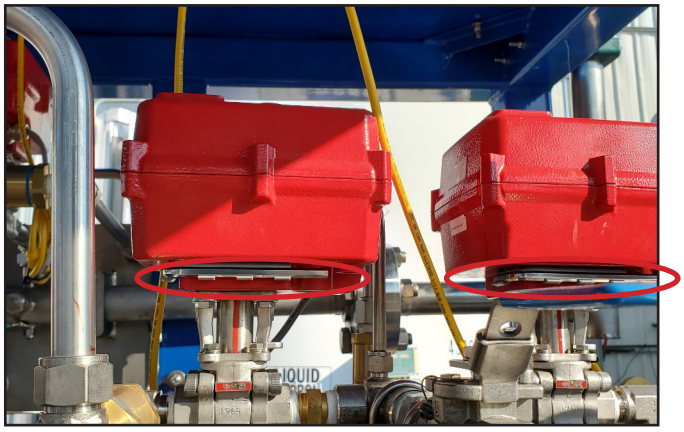


Here, select the "MANUAL" button, which will bring up the Manual Control screen

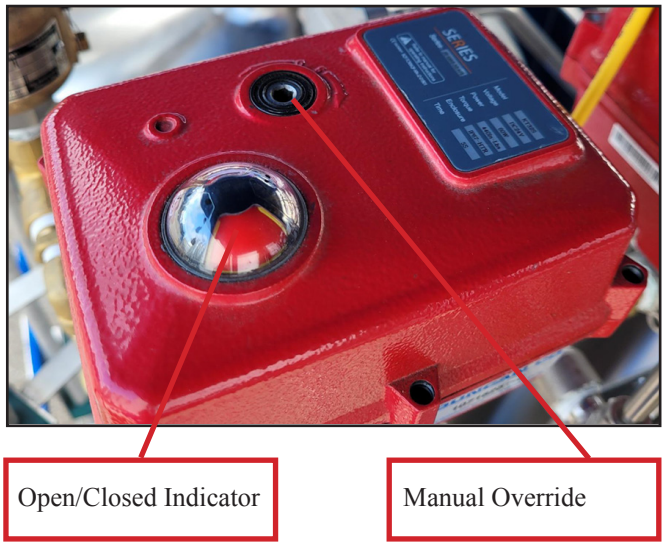


Press the "manual" button. When the Trifecta is in manual control, "Manual" will be highlighted in blue. You can press the open button and the red "OFF" will turn to a green "ON" and the valve will open and stay open until you press the "CLOSE" button. You can view the tank pressure and liquid level on the right side. If you are operating it manually, you will be able to see what is going on.

The actuated ball valves have a manual override allowing the valve to be opened or closed by inserting the supplied allen key, located on the bottom of the red actuator, into the female receptacle on top of the valve and rotating left or right depending on mode desired:



- Turning the allen key counter-clockwise opens or closes the valve. A view window on the top of the valve indicates red for closed and yellow for open.
- The actuator has a super-capacitor that will fail in the closed position in the event of a power-outage.



Control Box

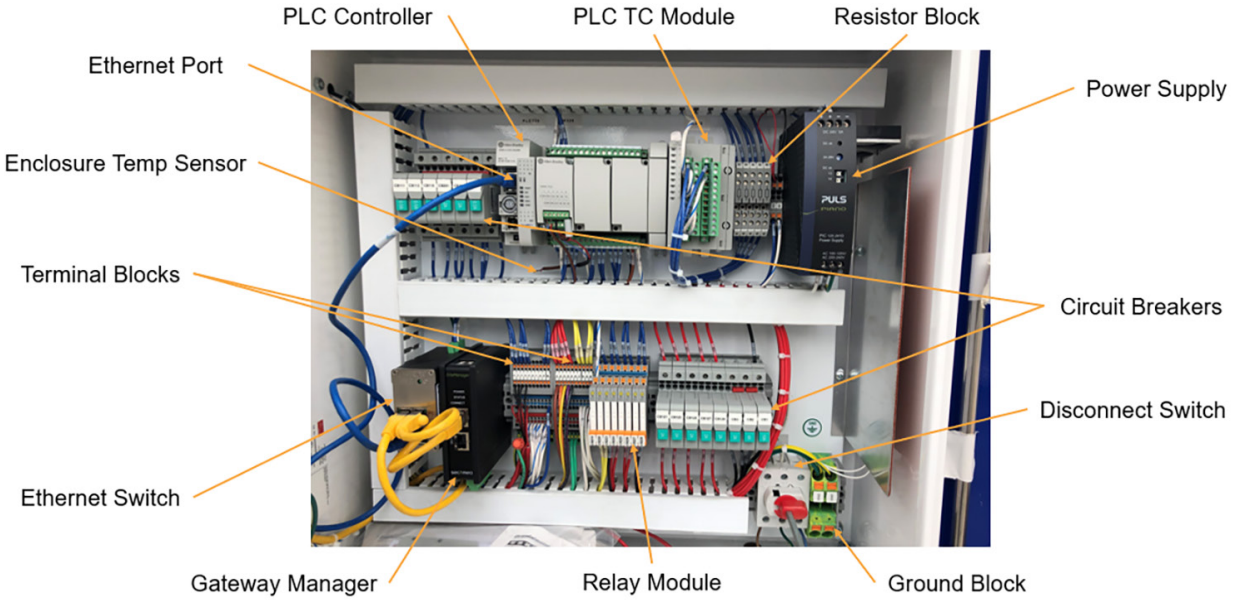


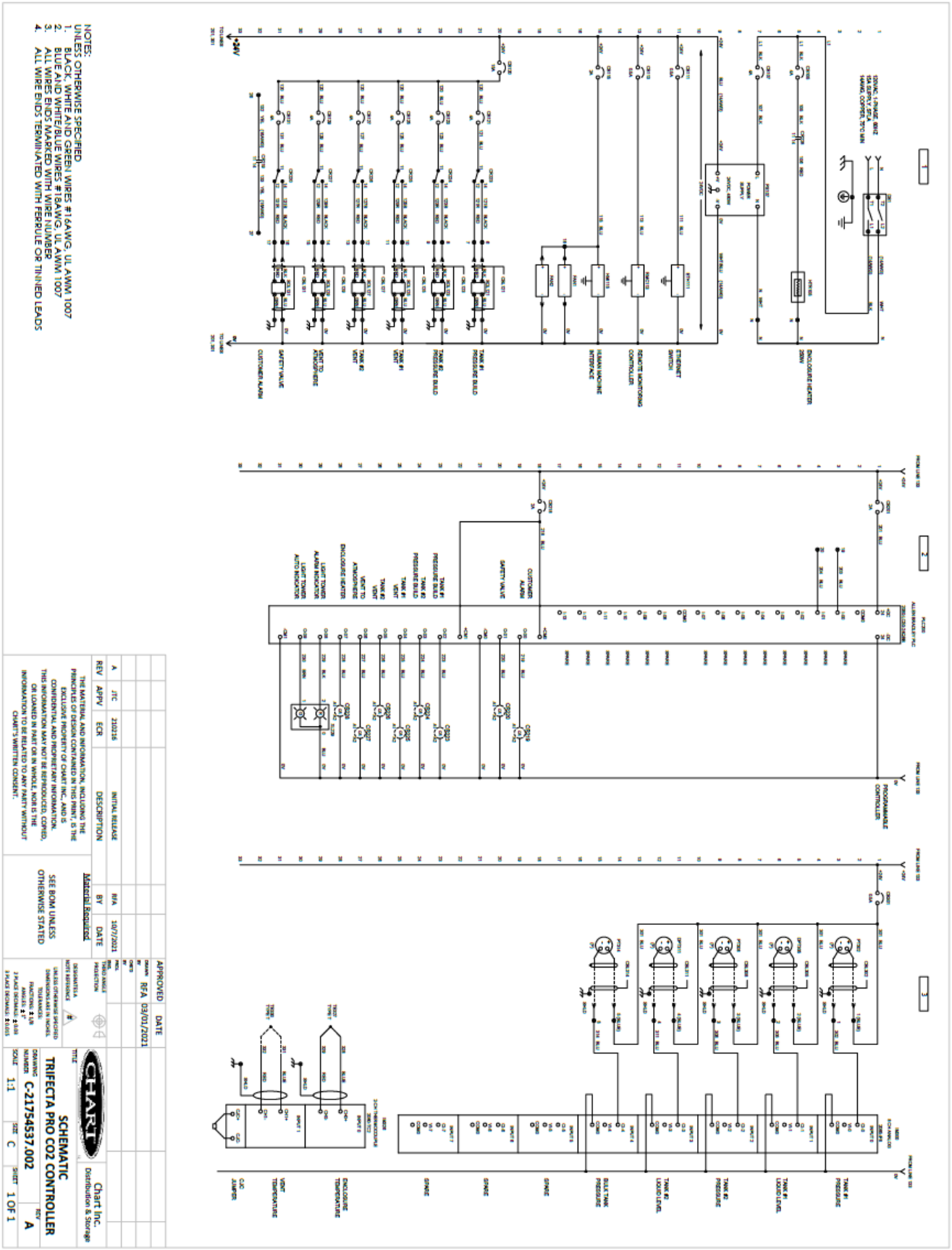
Figure 3 Primary Components Inside Allen Bradley Panel

Circuit Breakers

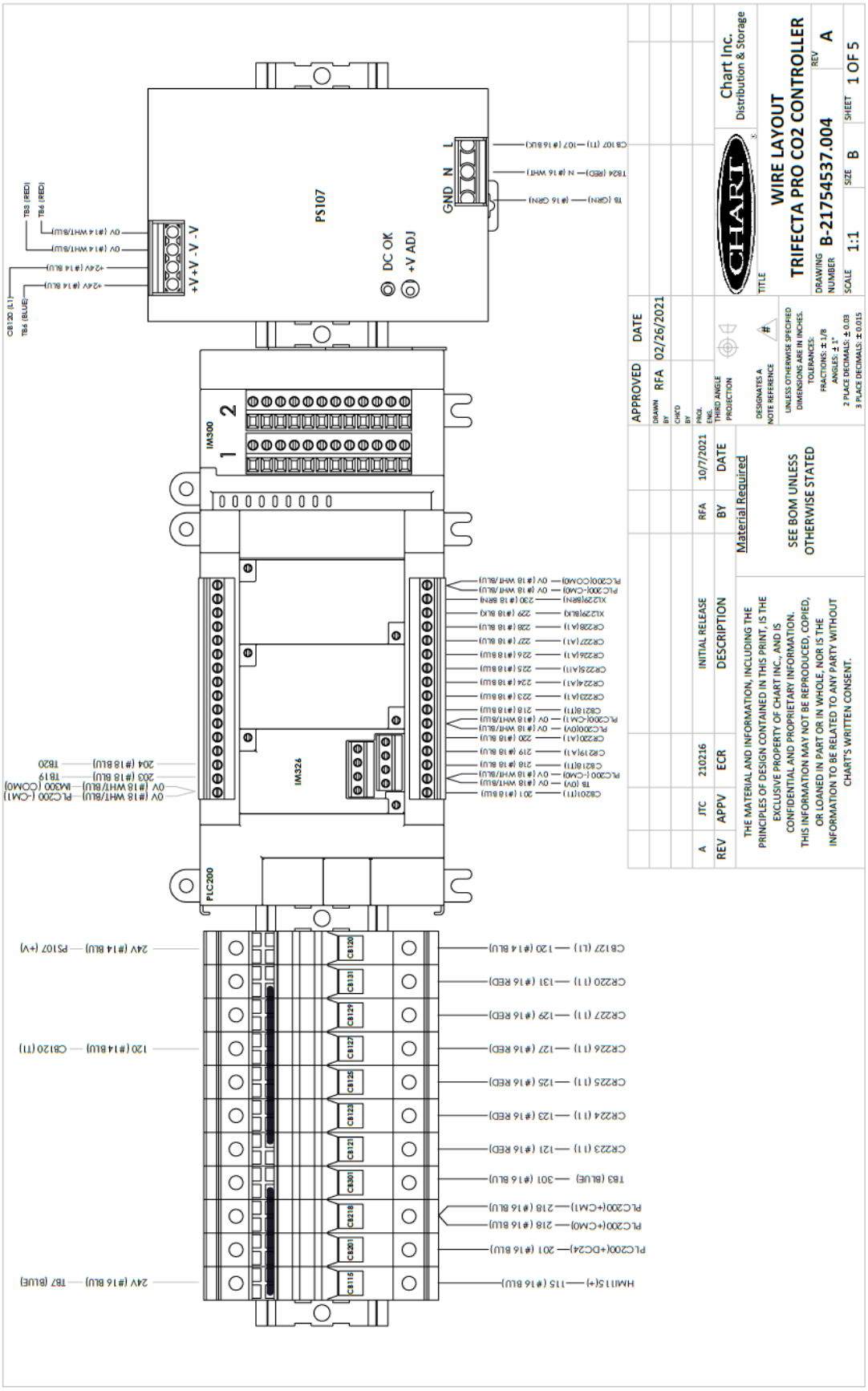
Circuit Breaker No.	Description	Amps
CB105 (120 VAC)	Enclosure Heater CB	4A
CB107 (120 VAC)	Power Supply CB	4A
CB111 (24 VDC)	Ethernet Switch	.5A
CB113 (24 VDC)	Remote Monitor Controller	.5A
CB115 (24 VDC)	HMI Interface	2A
CB120 (24 VDC)	Main CB for actuated valves	15A
CB121 (24 VDC)	Tank #1 Pressure Build	4A
CB123 (24 VDC)	Tank #2 Pressure Build	4A
CB 125 (24 VDC)	Tank #1 Vent	4A
CB127 (24 VDC)	Tank #2 Vent	4A
CB129 (24 VDC)	Vent to Atmosphere	4A
CB131 (24 VDC)	Liquid Use Shutoff Valve	4A
CB201 (24 VDC)	Allen Bradley PLC	2A
CB218 (24 VDC)	Customer Alarm/Safety Valve	2A
CB301 (24 VDC)	Transmitters	.5A

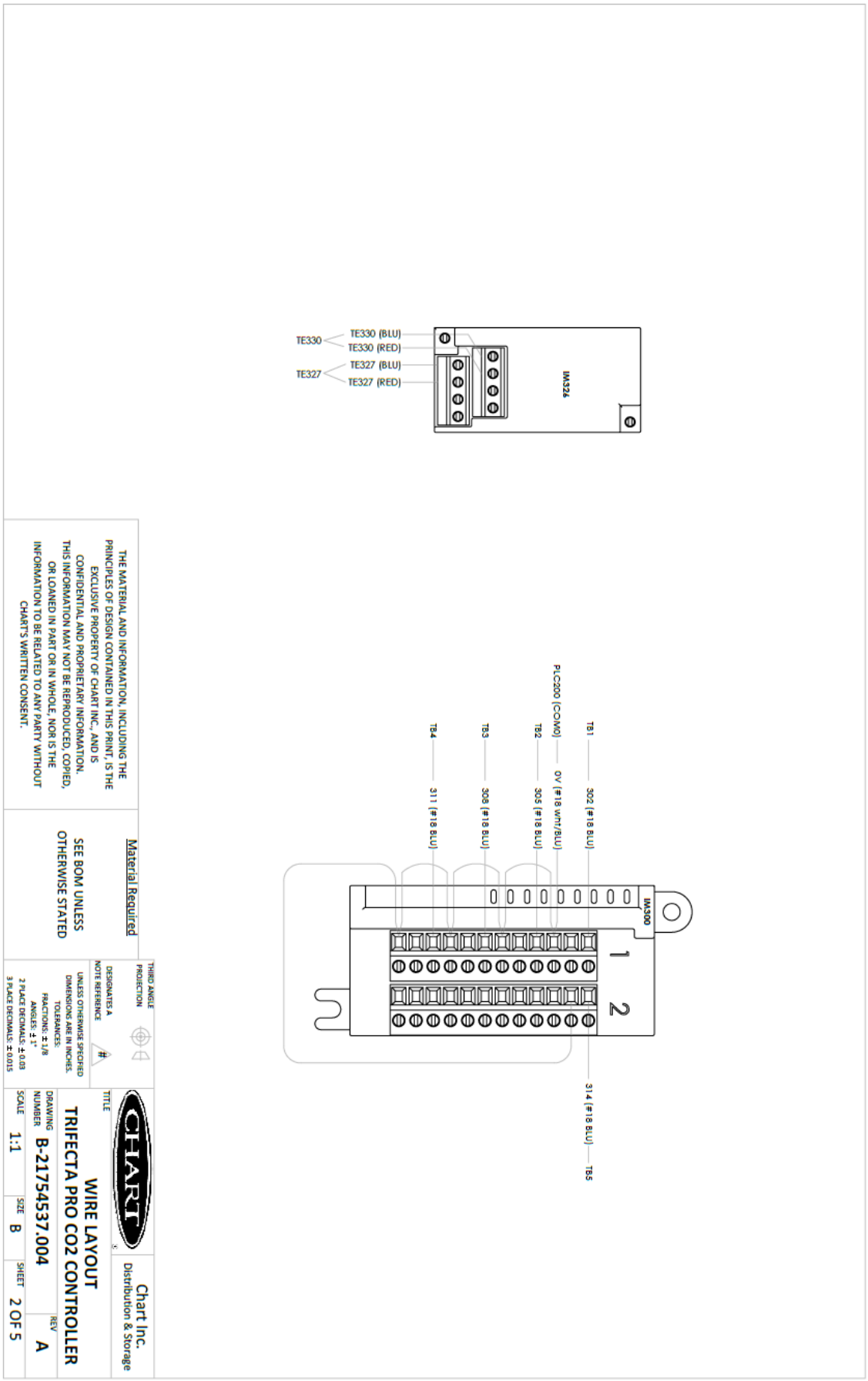
Note: Reset tripped circuit breaker by pushing in on square green button. Before resetting, it is best to understand why the circuit breaker tripped..

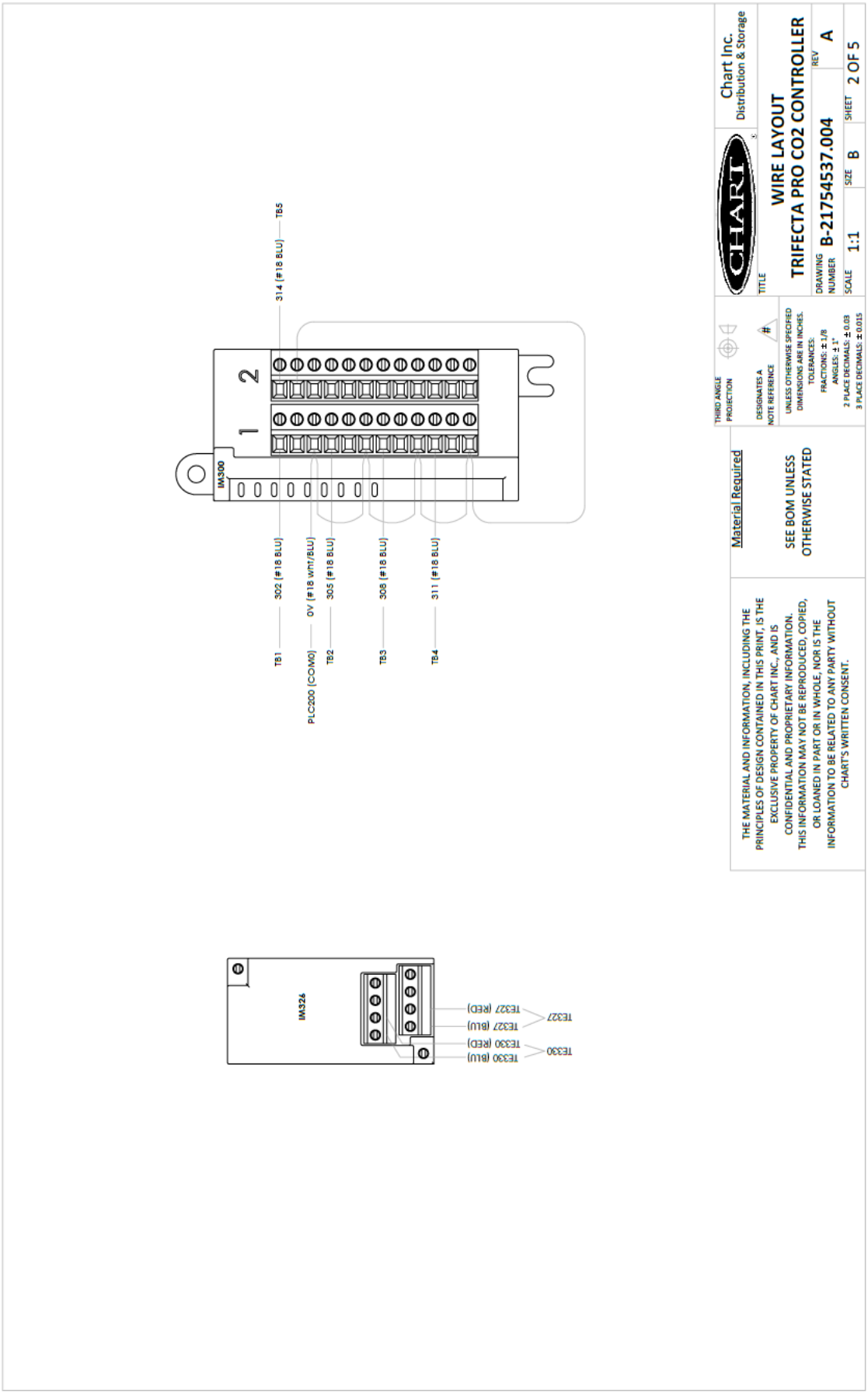
Control Panel Schematic

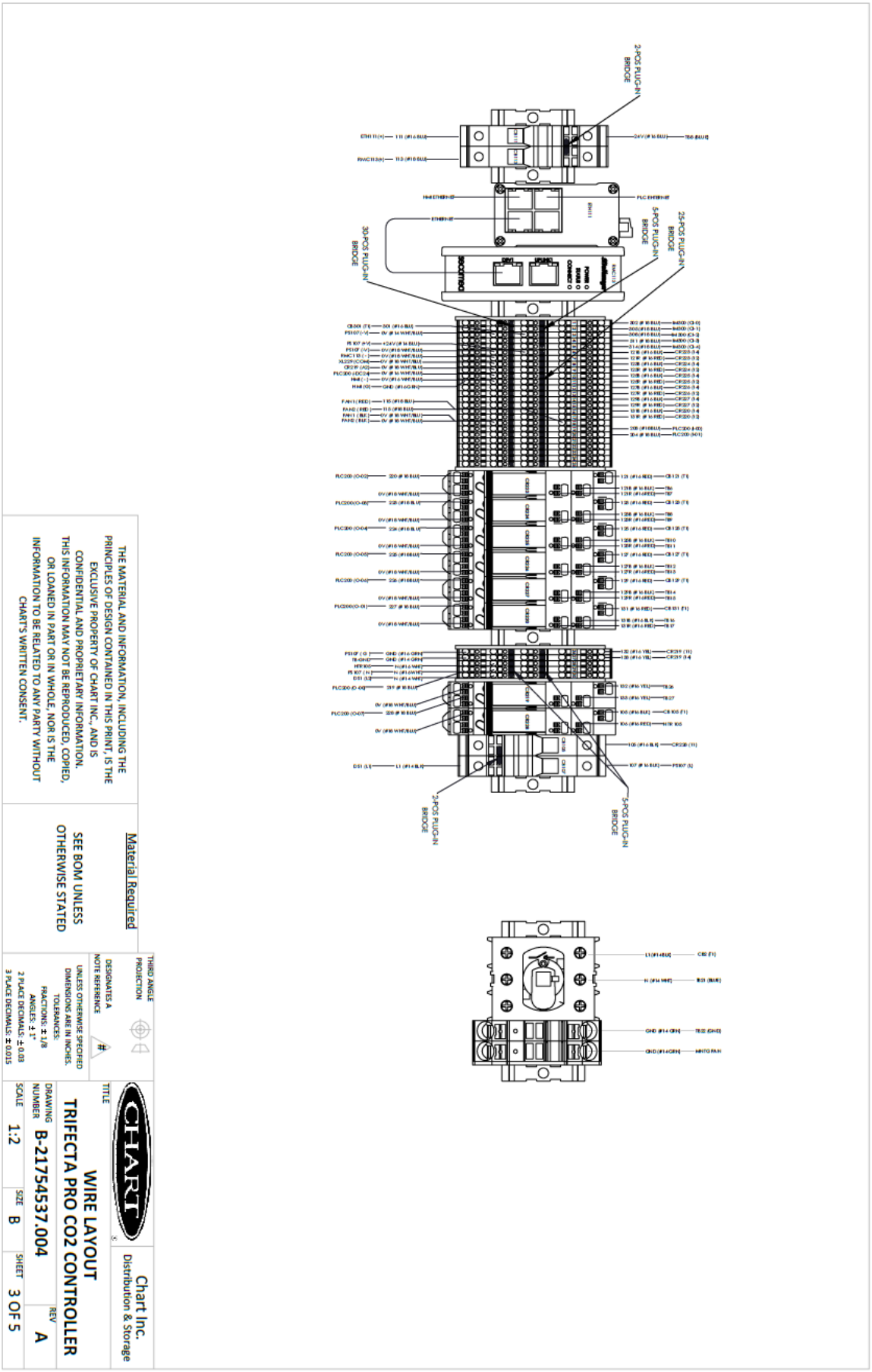


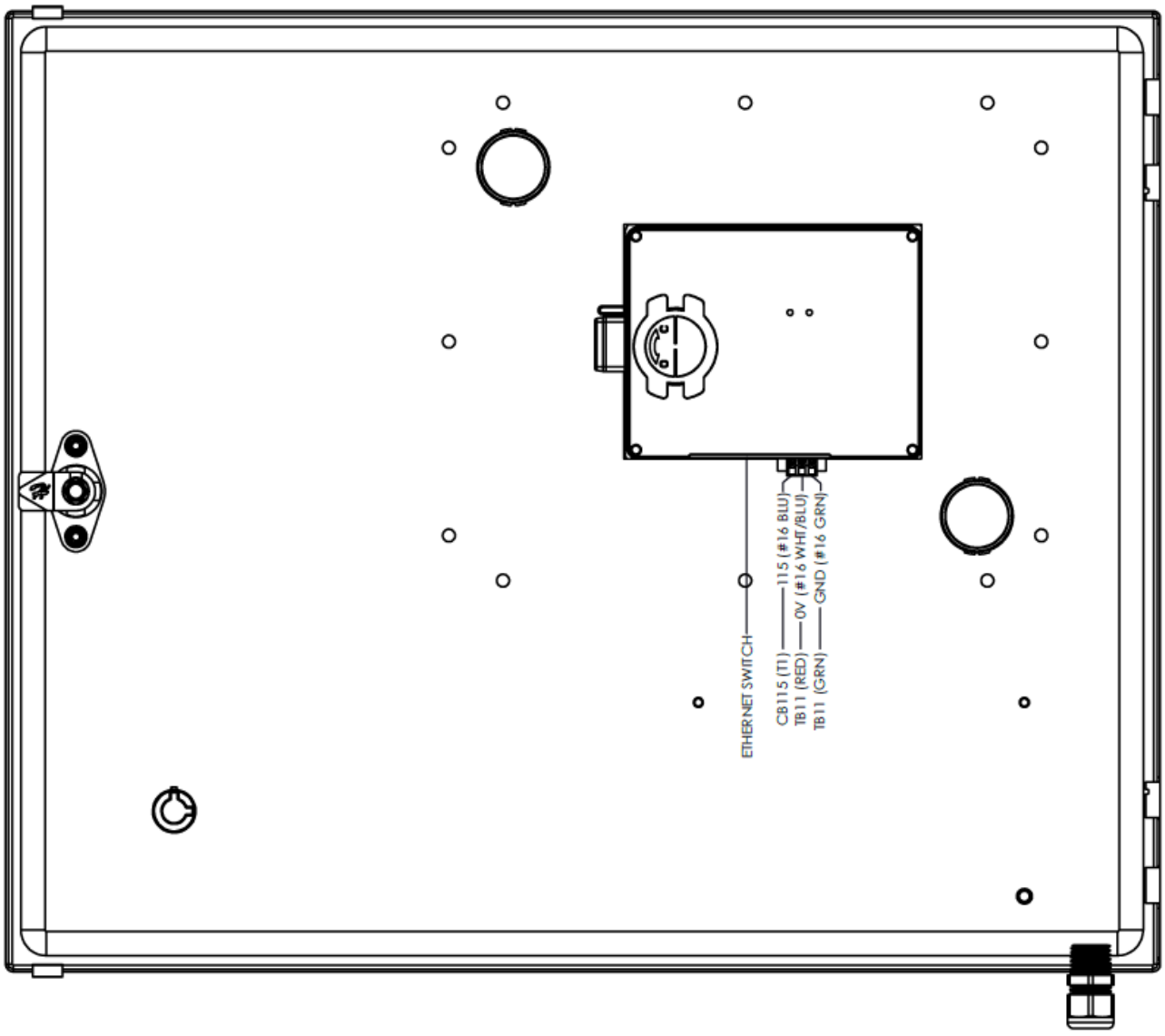
Control Panel Wire Layout



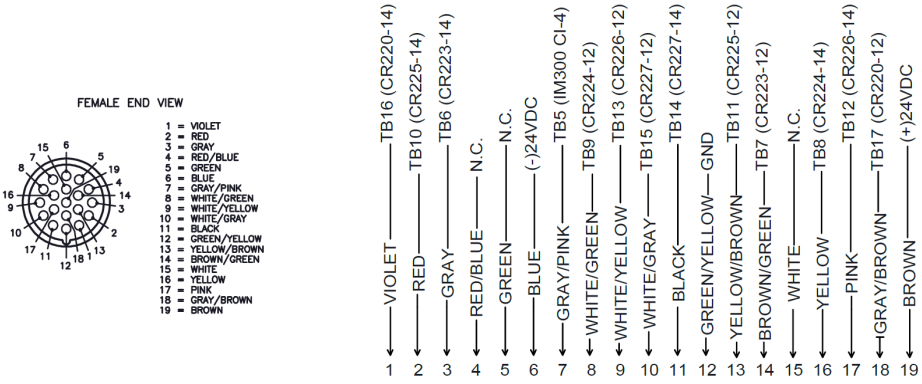

TE330
TE330 (BLU)
TE330 (RED)
TE327
TE327 (BLU)
TE327 (RED)
IM326
IM300
PLC200 (COMM)
0V (#18 wht/BLU)
TB1
TB2
TB3
TB4
TB5
302 (#18 BLU)
305 (#18 BLU)
308 (#18 BLU)
311 (#18 BLU)
314 (#18 BLU)
1
2
THIRD ANGLE PROJECTION
DESIGNATES A NOTE REFERENCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES:
FRACTIONS: ± 1/8
ANGLES: ± 1°
2 PLACE DECIMALS: ± 0.03
3 PLACE DECIMALS: ± 0.015
Material Required
SEE BOM UNLESS OTHERWISE STATED
THE MATERIAL AND INFORMATION, INCLUDING THE PRINCIPLES OF DESIGN CONTAINED IN THIS PRINT, IS THE EXCLUSIVE PROPERTY OF CHART INC., AND IS CONFIDENTIAL AND PROPRIETARY INFORMATION. THIS INFORMATION MAY NOT BE REPRODUCED, COPIED, OR LOANED IN PART OR IN WHOLE, NOR IS THE INFORMATION TO BE RELATED TO ANY PARTY WITHOUT CHART'S WRITTEN CONSENT.
CHART
Chart Inc.
Distribution & Storage
TITLE
WIRE LAYOUT
TRIFECTA PRO CO2 CONTROLLER
DRAWING NUMBER
B-21754537.004
REV
A
SCALE
1:1
SIZE
B
SHEET
2 OF 5


IM300
1
2
TB1
TB2
TB3
TB4
TB5
302 (#18 BLU)
0V (#18 WHT/BLU)
305 (#18 BLU)
308 (#18 BLU)
311 (#18 BLU)
314 (#18 BLU)
PLC200 (COMM)
IM326
TE330
TE327
TE330 (BLU)
TE330 (RED)
TE327 (BLU)
TE327 (RED)
Chart Inc.
Distribution & Storage
CHART
TITLE
WIRE LAYOUT
TRIFECTA PRO CO2 CONTROLLER
DRAWING NUMBER B-21754537.004
REV A
SCALE 1:1
SIZE B
SHEET 2 OF 5
THIRD ANGLE PROJECTION
DESIGNATES A NOTE REFERENCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES:
FRACTIONS: ± 1/8
ANGLES: ± 1°
2 PLACE DECIMALS: ± 0.03
3 PLACE DECIMALS: ± 0.015
Material Required
SEE BOM UNLESS OTHERWISE STATED
THE MATERIAL AND INFORMATION, INCLUDING THE PRINCIPLES OF DESIGN CONTAINED IN THIS PRINT, IS THE EXCLUSIVE PROPERTY OF CHART INC., AND IS CONFIDENTIAL AND PROPRIETARY INFORMATION. THIS INFORMATION MAY NOT BE REPRODUCED, COPIED, OR LOANED IN PART OR IN WHOLE, NOR IS THE INFORMATION TO BE RELATED TO ANY PARTY WITHOUT CHART'S WRITTEN CONSENT.

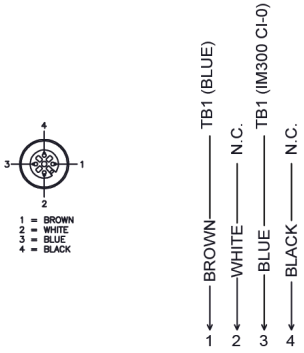

2-POS PLUG-IN BRIDGE
30-POS PLUG-IN BRIDGE
5-POS PLUG-IN BRIDGE
25-POS PLUG-IN BRIDGE
2-POS PLUG-IN BRIDGE
5-POS PLUG-IN BRIDGE
THE MATERIAL AND INFORMATION, INCLUDING THE PRINCIPLES OF DESIGN CONTAINED IN THIS PRINT, IS THE EXCLUSIVE PROPERTY OF CHART INC., AND IS CONFIDENTIAL AND PROPRIETARY INFORMATION. THIS INFORMATION MAY NOT BE REPRODUCED, COPIED, OR LOANED IN PART OR IN WHOLE, NOR IS THE INFORMATION TO BE RELATED TO ANY PARTY WITHOUT CHART'S WRITTEN CONSENT.
Material Required
SEE BOM UNLESS OTHERWISE STATED
THIRD ANGLE PROJECTION
DESIGNATES A NOTE REFERENCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES:
FRACTIONS: ± 1/8
ANGLES: ± 1°
2 PLACE DECIMALS: ± 0.03
3 PLACE DECIMALS: ± 0.015
CHART
Chart Inc.
Distribution & Storage
TITLE
WIRE LAYOUT
TRIFECTA PRO CO2 CONTROLLER
DRAWING NUMBER
B-21754537.004
REV
A
SCALE
1:2
SIZE
B
SHEET
3 OF 5



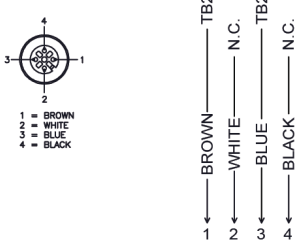
HMI Wire Layout



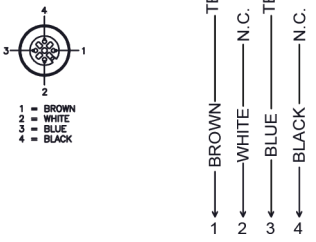
RECEPTACLE: VALVES AND BULK TANK PRESSURE



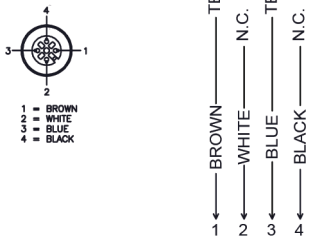
RECEPTACLE: TANK #1 PRESSURE



RECEPTACLE: TANK #1 LEVEL

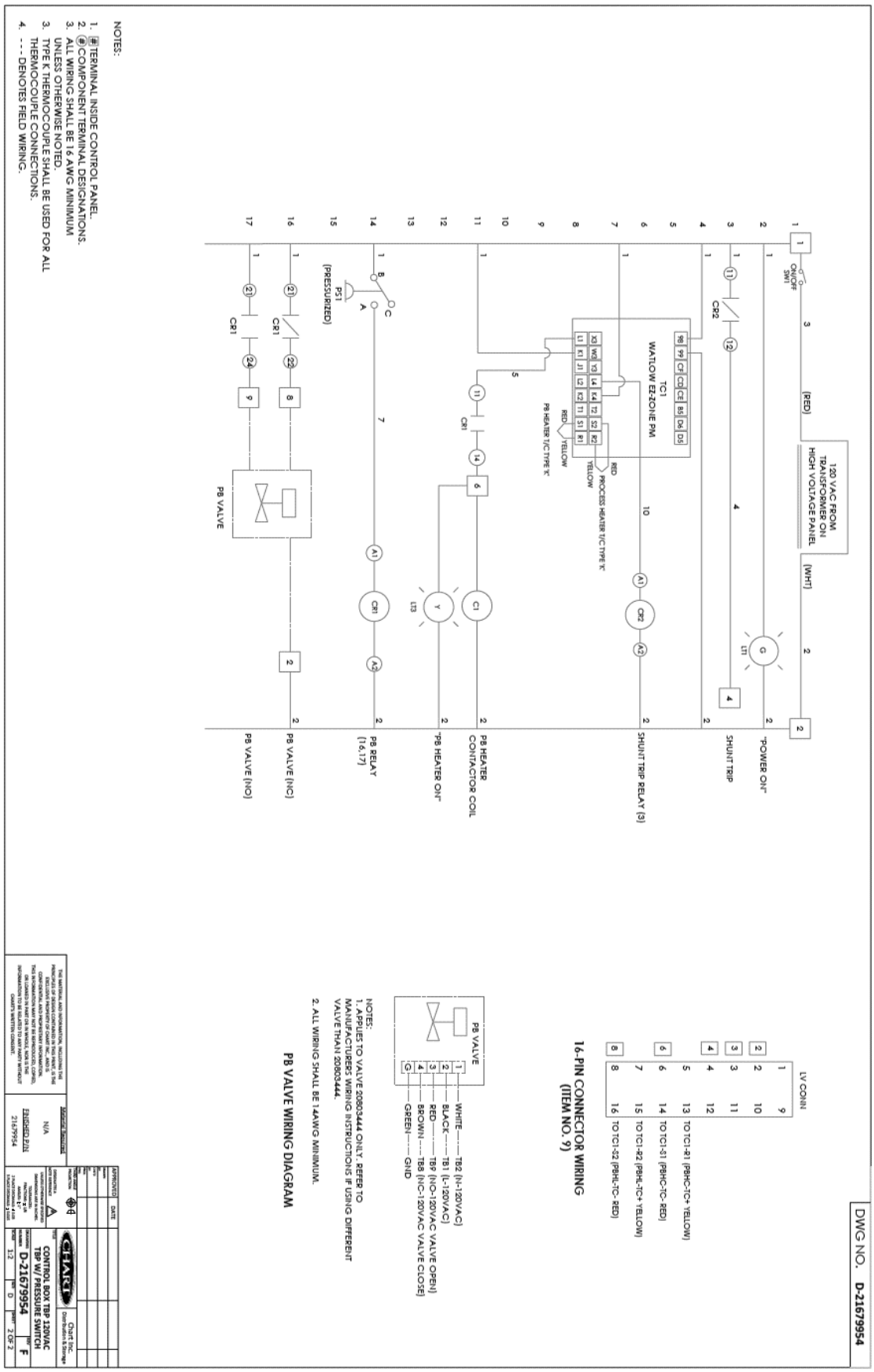


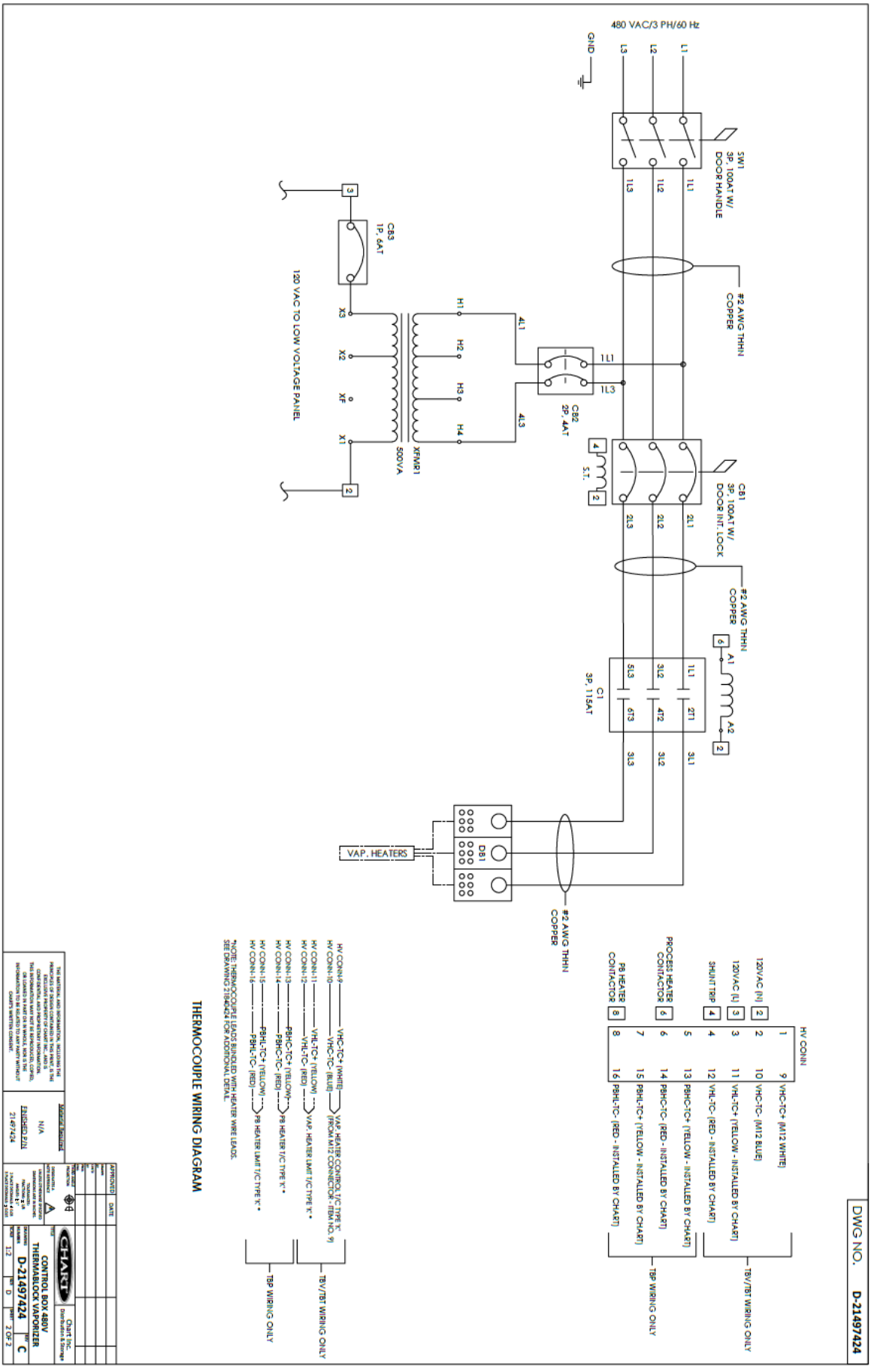
RECEPTACLE: TANK #2 PRESSURE



RECEPTACLE: TANK #2 LEVEL

PB Vaporizer Electrical Schematics




480 VAC/3 PH/60 Hz
GND
L3
L2
L1
SW1
3P, 100AT W/
DOOR HANDLE
#2 AWG THHN
COPPER
CB3
1P, 6AT
120 VAC TO LOW VOLTAGE PANEL
XFMR1
500VA
CB2
2P, 4AT
S.T.
CB1
3P, 100AT W/
DOOR INT. LOCK
C1
3P, 115AT
A1
A2
VAP. HEATERS
D81
#2 AWG THHN
COPPER
HV CONN
9 VHC-TC+ (M12 WHITE)
10 VHC-TC- (M12 BLUE)
11 VHL-TC+ (YELLOW - INSTALLED BY CHART)
12 VHL-TC- (RED - INSTALLED BY CHART)
13 PBHC-TC+ (YELLOW - INSTALLED BY CHART)
14 PBHC-TC- (RED - INSTALLED BY CHART)
15 PBHL-TC+ (YELLOW - INSTALLED BY CHART)
16 PBHL-TC- (RED - INSTALLED BY CHART)
120VAC (N)
120VAC (L)
SHUNT TRIP
PROCESS HEATER CONTACTOR
PB HEATER CONTACTOR
TBV/TBT WIRING ONLY
TBP WIRING ONLY
HV CONN-9 VHC-TC+ (WHITE)
HV CONN-10 VHC-TC- (BLUE)
VAP. HEATER CONTROL T/C TYPE 'K'
(FROM M12 CONNECTOR - ITEM NO. 9)
HV CONN-11 VHL-TC+ (YELLOW)
HV CONN-12 VHL-TC- (RED)
VAP. HEATER LIMIT T/C TYPE 'K' *
HV CONN-13 PBHC-TC+ (YELLOW)
HV CONN-14 PBHC-TC- (RED)
PB HEATER T/C TYPE 'K' *
HV CONN-15 PBHL-TC+ (YELLOW)
HV CONN-16 PBHL-TC- (RED)
PB HEATER LIMIT T/C TYPE 'K' *
*NOTE: THERMOCOUPLE LEADS BUNDLED WITH HEATER WIRE LEADS.
SEE DRAWING 21184424 FOR ADDITIONAL DETAIL.
THERMOCOUPLE WIRING DIAGRAM
DWG NO. D-2149424
CONTROL BOX 480V
THERMABLOCK VAPORIZER
D-2149424
C
Chart Inc.
SHEET 2 OF 2
SIZE D
SCALE 1:2
ENGINEERING
21497424
N/A
APPROVED
DATE

Repairs

Note: Any time plumbing is removed from the Trifecta Pro CO_2 system, take care not to allow any moisture to enter the system. This moisture can freeze and cause check valves and control valves to stick. Critical lines can freeze causing incorrect level and pressure readings.

Check Valve Leaking

If you find that there is a leaking check valve, the Trifecta Pro CO_2 will have to be emptied and depressurized or the plumbing circuit isolated and drained. The check valve should then be replaced. Replacement parts can be found in the Preventive Maintenance section on this manual and ordered on www.chartparts.com.

Actuated Valves

If the actuator appears to be malfunctioning, it could be for a few reasons:

- PLC is not sending signal to energize the actuated valve.
- Moisture in valve or actuator.

The most common symptoms of these failures and their remedies are described in the following sections:

Non-Energizing Actuator

The PLC sends a signal to the valve to energize the actuator during a particular operation of the Trifecta Pro CO_2. When this signal is sent from the PLC, the actuated valve shown on the HMI Screen turns green. If the actuated valve turns green, but the valve does not open, check for loose wiring and voltage at the actuated valve with a multi-meter. If there is power at the valve and the valve does not open, the actuator will need to be repaired or replaced. If there is not power at the valve, trace the wiring back to find out where the disconnect is occurring. Contact http://www.chartparts.com for replacement parts.

Contaminants on Valve Seals

If the valve appears to be leaking, there are most likely contaminants on the seal of the stem. The seal may also be damaged. In this case, replace the seal. Also verify that the strainer is in place and replace if it has been six months prior to last replacement.

Moisture in Valve

Actuator should be allowed to thaw. Once thawed, moisture may be removed from actuator upon next use via the flow of new gas.

Actuator Failure

If none of the above improves the situation, there has been a catastrophic failure within the actuated valve. The entire valve assembly must be replaced.

Leaking Components

If the leak cannot be fixed via tightening or re-plumbing a component, a new component will have to be fitted. Refer to the Preventive Maintenance section of this manual to locate the description and part number of this component.

Note: All replacement fittings should be cleaned for oxygen service. Refer to replacement part section for Chart part numbers for all plumbing components.

Pressure and Liquid Level Transmitters

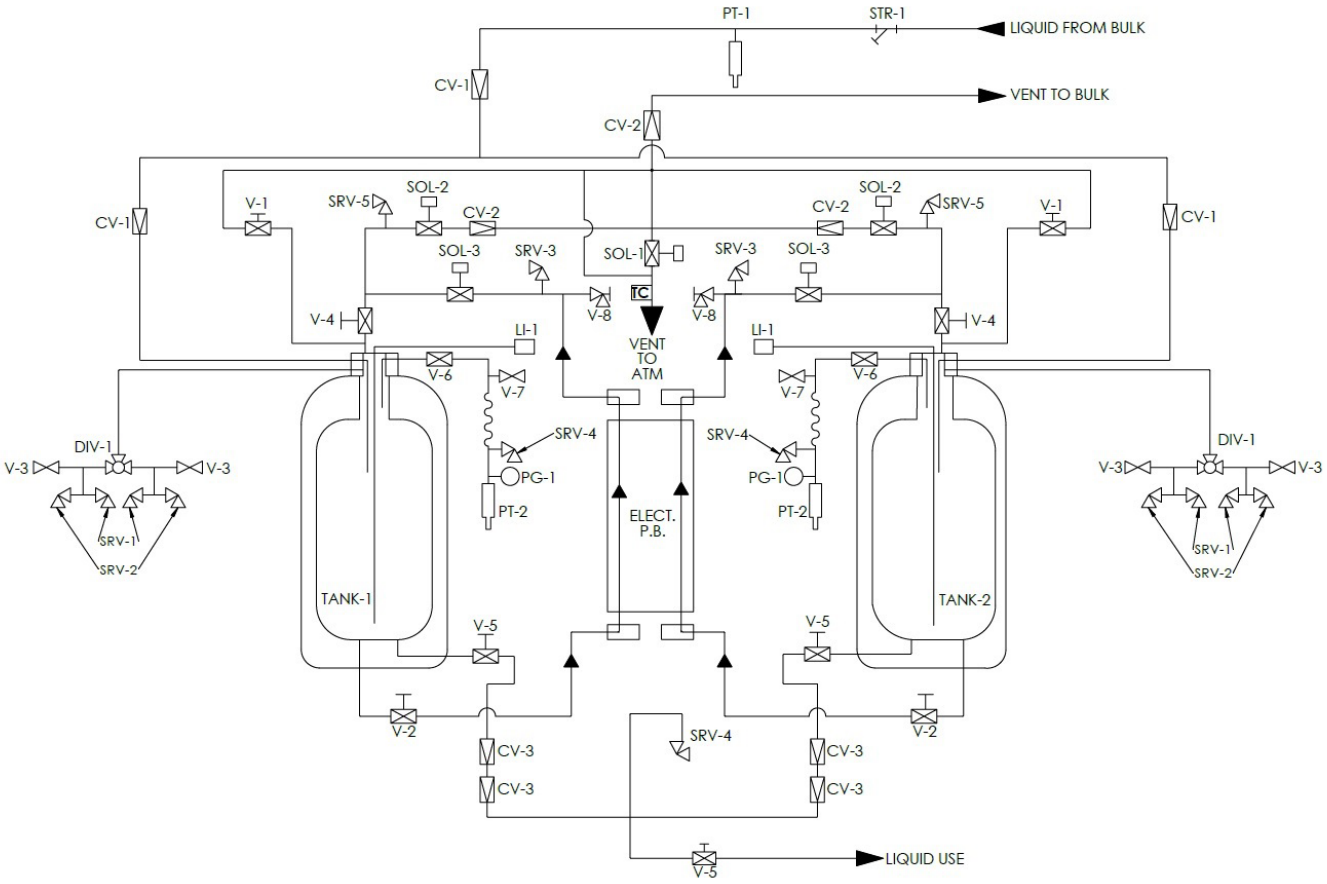
- Leak check all fittings associated with the pressure transmitter to verify the circuit has zero leaks. The sensor error check function is designed to find problems such as a wire coming disconnected, or a short in the transmitter. See the Service section of this manual for Alerts and Alarms.
- Confirm that all wiring connection terminals on the pressure and liquid level are tight.
- If all connections are made and the Alarm condition does not go away, check the transmitter output.
- Recalibrate or replace the transmitter as necessary.
- Also verify display readouts versus the analog gauges for both pressure and liquid level.

Ball Valve Maintenance and Repair

Extended stem and short stem Worcester cryogenically-rated ball valves are used for isolation valves. These valves, for the most part, stay in the open position. Chart recommends these ball valves have their stem seals checked and tightened at least every six months. Ball seals should also be checked at least once per year and replaced as required.

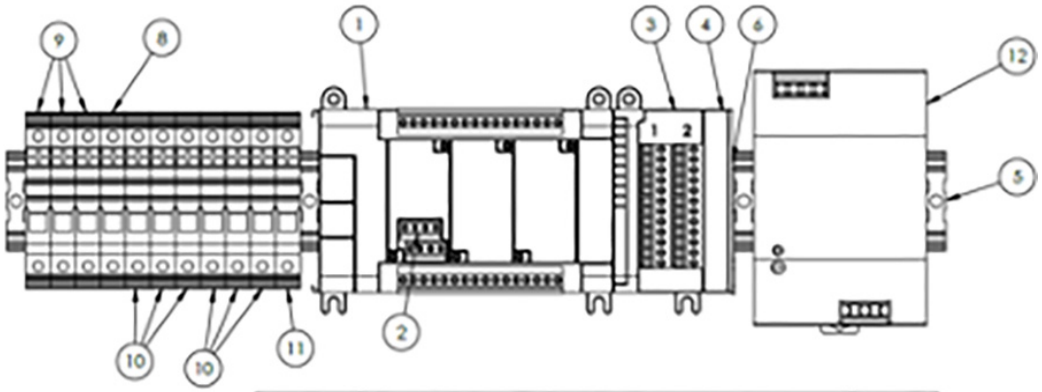
Replacement Parts (Piping)

Reference Piping Schematic below for part ID labels.

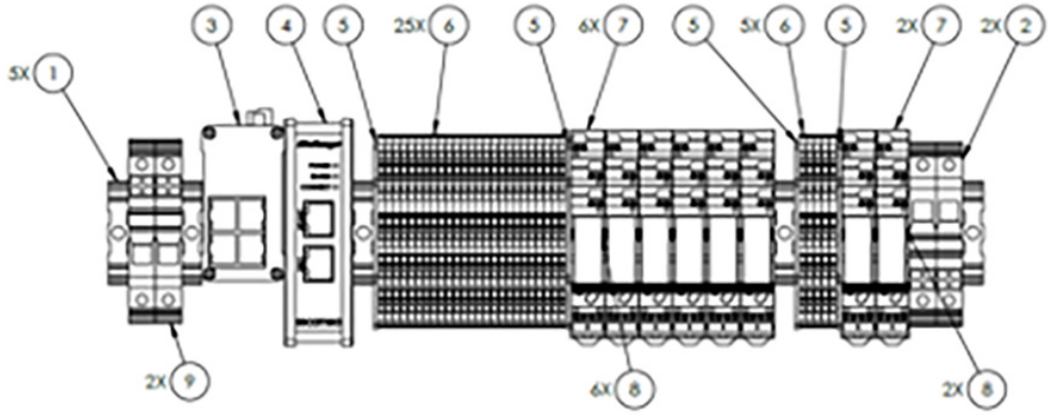


LABEL	DESCRIPTION	CHART	ITEM DESCRIPTION	MANUFACTURER
LI-1	LIQUID LEVEL INDICATOR	20897094	C-STIC CAPACITANCE GAUGE BOX	ROTAREX
PBV	PRESSURE BUILDING VAPORIZER	21927124	ELECTRIC VAPORIZER	CHART
PG-1	TANK PRESSURE GAUGE	21481166	PRESSURE GAUGE (0-1200 PSI)	WIKA
SRV-1	TANK SAFTY RELIEF VALVE	21486189	RV BRS 1/2MPT 1020 PSI	GENERANT
SRV-2	TANK SAFTY RELIEF VALVE	21486187	RV BRS 1/2MPT 930PSI	AQUATROL
SRV-3	SECONDARY RELIEF VALVE	21486189	RV BRS 1/2MPT 1020 PSI	GENERANT
SRV-4	LINE RELIEF VALVE	21486188	RV BRS 1/4MPT 1115 PSI	GENERANT
SRV-5	VENT RELIEF VALVE	21486189	RV BRS 1/2MPT 1020 PSI	GENERANT
PT-1	BULK PRESSURE TRANSMITTER	21463486	TRANSDUCER PRESS 0-1000 PSI	WIKA
PT-2	PRESSURE TRANSMITTER TRI-FECTA	21463486	TRANSDUCER PRESS 0-1000 PSI	WIKA
STR-1	FILL STRAINER	21497081	STRAINER 3/4"FPT Y-TYPE	MAGNATROL
SOL-1	VENT TO ATMOSPHERE SOLE-NOID VALVE	21721178	VALVE BALL SS 1/2"FPT ELEC ACT 24V	HABONIM
SOL-2	PRESSURE BUILD SOLENOID VALVE	21721178	VALVE BALL SS 1/2"FPT ELEC ACT 24V	HABONIM
SOL-3	PRESSURE BUILD SOLENOID VALVE	21721178	VALVE BALL SS 1/2"FPT ELEC ACT 24V	HABONIM
SOL-4	Liquid Use Sbutoff Valve	22117647	VALVE BALL SS 1/2”FPT M12 W/ EX	HABONIM
TANK-1	CHART LASER-CYL 200L	21463987	LASER-CYL 200L	CHART
TANK-2	CHART LASER-CYL 200L	21463984	LASER-CYL 200L	CHART
TC	THERMOCOUPLE TYPE T	21809512	THERMOCOUPLE TYPE T	OMEGA
DIV-1	TANK SAFETY DIVERTER VALVE	21466826	VALVE BALL DIV SS 3/4 NPT	QUADRANT
CV-1	FILL CHECK VALVE	13620233	VALVE CHECK BRS 1/2FPTX-1/2FPT	GENERANT
CV-2	VENT CHECK VALVE	13620233	VALVE CHECK BRS 1/2FPTX-1/2FPT	GENERANT
CV-3	LIQUID USE CHECK VALVE	13620233	VALVE CHECK BRS 1/2FPTX-1/2FPT	GENERANT
V-1	MANUAL VENT VALVE	12930184	1/2 FPT VALVE BALL	JAMESBURY
V-2	P.B. ISOLATION VALVE	21168461	VALVE BALL 1/2 FPT	WORCESTER
V-3	SAFTY PURGE VALVE	10907239	VALVE NEEDLE BRS 1/4MPT	REGO
V-4	VENT / P.B. ISOLATION VALVE	12930184	1/2 FPT VALVE BALL	JAMESBURY
V-5	LIQUID USE ISOLATION VALVE	21168461	VALVE BALL 1/2 FPT	WORCESTER
V-6	VALVE STEM	21815888	VALVE STEM SS 1/4MPT	SWAGELOK
V-7	INSTRUMENT PURGE VALVE	21890807	VALVE STEM SS 1/4MPT	SWAGELOK
V-8	P.B. PURGE VALVE	10907239	VALVE NEEDLE BRS 1/4MPT	REGO
V-9	Use Line Purge Valve	10907239	Valve Needle BRS 1/4MPT	REGO

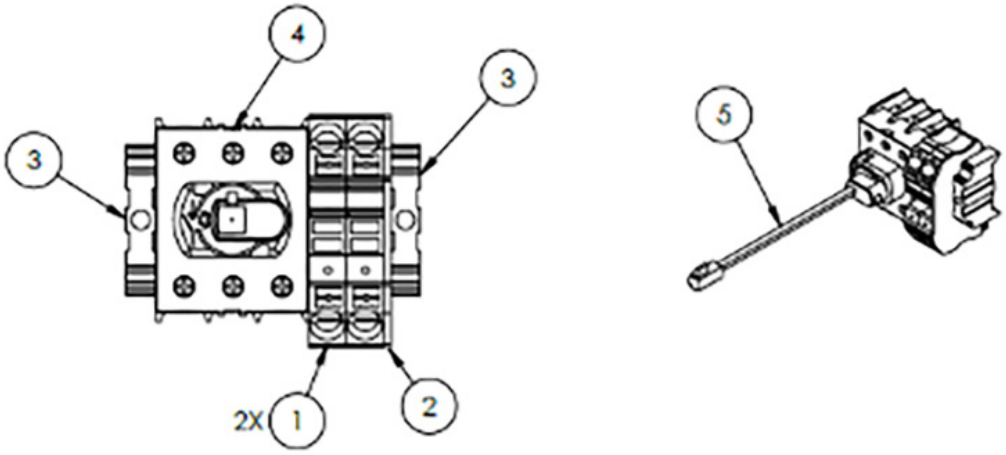
Replacement Parts (Electrical)



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	351004.1201.0001	PLC CONTROLLER	1
2	351004.1202.0003	PLC TC MODULE	1
3	351004.1202.0002	PLC MODULE	1
4	351004.1202.0001	PLC TERMINATOR	1
5	351007.1702.0001	DIN-RAIL ANCHOR	4
6	351007.2102.0001	TERMINAL BLOCK END PLATE	1
8	351009.1101.0050	CIRCUIT BREAKER 0.5A	1
9	351009.1101.0200	CIRCUIT BREAKER 2A	3
10	351009.1101.0400	CIRCUIT BREAKER 4A	6
11	21773322	CIRCUIT BREAKER 15A	1
12	21754592	POWER SUPPLY	1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	351007.1702.0001	DIN-RAIL ANCHOR	5
2	351009.1101.0400	CIRCUIT BREAKER 4A	2
3	351004.2101.0001	ETHERNET SWITCH	1
4	351004.3101.0001	GATEWAY MANAGER	1
5	351007.1701.0001	TERMINAL BLOCK PARTITION	4
6	351007.1201.0001	TERMINAL BLOCK	30
7	21756593	RELAY MODULE BASE	8
8	21754594	RELAY MODULE	8
9	351009.1101.0050	CIRCUIT BREAKER 0.5A	2



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	351007.1101.0006	GROUND BLOCK	2
2	351007.1100.0001	TERMINAL BLOCK END PLATE	1
3	351007.1702.0001	DIN-RAIL ANCHOR	2
4	351009.2101.0016	DISCONNECT SWITCH	1
5	351009.2201.0200	INTERLOCK SHAFT	1

Preventative Maintenance

Over time, components of the Trifecta Pro CO_2 (as in any mechanical system) can degrade and/or fail if not properly maintained. For this reason, a regular maintenance procedure is recommended to prevent any unexpected downtime.

The most common field failures are due to:

- Clogged fill line strainer or strainer having been completely removed by service technician permitting entry of debris to system
- Malfunctioning Actuators and Check Valves (leaks) caused by
  - – Buildup of impurities of liquid fed to the system from the bulk tank
  - – Introduction of moisture to the bulk system without proper purge process
  - – Normal wear and tear of actuators and seats due to cycling
  - – Debris entering Trifecta from Bulk tank due to removed strainer
- Leaking Fittings
  - – All connections are leak checked from the factory and should be re-checked periodically
  - – All replaced fittings in the field must be checked to ensure proper operation
- Malfunctioning Cylinder Relief's
  - – Relief Valve opening at lower pressure than set point

With a regular maintenance procedure, these possible failures and corresponding down times can be prevented. To ensure uninterrupted operation, it is recommended that the following maintenance procedures be followed.

Every six months:

- Inspect or clean strainer on liquid feed line

NOTE: DO NOT OPERATE SYSTEM WITHOUT A FILL LINE STRAINER IN PLACE

Every Year:

- Verify two normal operation cycles
- Inspect integrity of all wire connections in control box. Tighten all loose connectors.
- Verify accuracy of analog gauges against pressure transmitters
- Leak check entire unit

Every Three Years or at cycle count limit (Recommended 20,000 cycles):

- Replace all check valves
- Rebuild actuators and rebuild actuated ball valves
- Replace tank relief valves

NOTE: RESET CYCLE COUNTER AFTER SERVICING THE VALVES.

Thermablock Troubleshooting and Preventative Maintenance

- See Thermablock Operating Manual part number 21602151

Notes

Manual No. 22003014
Revision C Dated 07/2023
Technical Service 800-253-1769,
Customer Service is 800-400-4683
www.chartparts.com