Product Manual

ChillZilla® Liquid Supply System
Liquid Nitrogen

Designed and Built by:

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Revision Log

Revision Level	Date	Description
A	03/01/2012	Original
B	11/19/2014	Reformat
C	06/28/2018	Update screens and specs
D	08/22/2021	Updated screens
E	02/20/2024	Updated Content

Preface

General

The ChillZilla Bulk LN_2 Liquid Supply System is engineered to provide consistent liquid nitrogen for optimum equipment performance. Ideally suited for Individually Quick Frozen (IQF), LN_2 immersion freezers, and cryobiological storage freezers, the ChillZilla LN_2 system features a Dynamic Pressure Builder™ for precise saturated liquid supply to the freezer regardless of the LN_2 liquid level. The ChillZilla system incorporates an insulation baffle to inhibit the mixing of fresh liquid from a trailer load delivery with the liquid supply to the freezer for better liquid supply stability during the refill.

With the aid of a patented high performance two-stage ambient pressure building coil, the heat management of this circuit is optimized for fast pressure recovery and reduced heat transfer to the contents. Coupling these unique features with the temperature monitoring of the liquid supply, a Programmable Logic Controller (PLC), VJ feed valve with an extended VJ pod and extended legs, the ChillZilla LN_2 system automatically provides the optimum liquid nitrogen supply to any liquid application.

Ideally suited for other LN_2 applications with the same demand, like cryogenic rubber and tire deflashing. Optional gas use conversion assembly available.

Product Highlights

- Dynamic Pressure Builder system for precise saturated LN_2 supply regardless of liquid level
- Insulation baffle with dedicated upper fill port for uninterrupted LN_2 supply during transport refill
- High performance two-stage ambient pressure builder vaporizer for maximum efficiency (20 gpm standard)
- PLC controller with actual LN_2 storage temperature, pressure and level monitoring for precise tank pressure control (PB and vent) with automatic desaturation capability
- High flow automatic pressure building valve improves response time and performance after a fill along with a tighter operating pressure dead-band
- Extended legs and vacuum insulated pod for increased head pressure aids in dampening LN_2 saturation pressure fluctuations
- Large 1-1/2” vacuum insulated inner supply line provides 20 gpm flow*
- Large 1-1/2” vacuum insulated isolation valve with mating female bayonet for plug-n-play to Chart VIP and ice-ball free operation
- Dual 125 psi main tank relief valves standard to protect downstream VIP system (175 psig tank MAWP)
- Reduced deliveries and improved inventory turn-over with 95% bulk tank capacity utilization
- High-performance Composite Super Insulation™ for ultra-low heat leak

*1-1/2” VIP system of 300’ VIP + 5 elbows + 2 valves = 2 psi pressure drop

Product Manual

This product manual is designed to be used in conjunction with ChillZilla LN_2 Liquid Supply Systems. If there are any questions regarding the operation of the tank, contact Chart’s Technical Service division at 1-800-400-4683.

This manual contains information regarding the safe operation and handling of LN_2. It should be thoroughly read and understood by anyone that operates the equipment.

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

The safety requirements for operating the tank 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 tank and the theory of operation.

In the Installation section there are illustration for how to uncrate and install the tank.

For information on how to operate the tank refer to the Operations section.

Refer to the Maintenance section for information on how to maintain the tank.

Terms

Throughout this manual safety precautions will be designated as follows:

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

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

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

Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

ASME	American Society of Mechanical Engineers
BAR	Pressure (Metric)
CGA	Compressed Gas Association
GPM	Gallons Per Minute
IQF	Individually Quick Frozen
Kg/cm^2	Kilogram-force per square centimeter
LN_2	Liquid Nitrogen
MAWP	Maximum Allowable Working Pressure
NER	Nominal Evaporation Rate
NFPA	National Fire Protection Association
PB	Pressure Builder
PLC	Programmable Logic Controller
PN	Part Number
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch (Gauge)
VIP	Vacuum Insulated Pipe
VJ	Vacuum Jacketed

Safety

General

All operators should have 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 cryogenic system, it should be observed that any non-insulated piping can get extremely cold and should not be touched by exposed skin. If the system requires maintenance, it should be shut down and allowed to warm-up.

Safety Summary

Strict compliance with proper safety and handling practices is necessary when using a cryogenic 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 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 and Inert Gases following this Safety Summary. Periodic review of the Safety Summary is recommended.

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.

Caution! To prevent possible tip over, do not leave 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 oxygen, nitrogen, argon, and cryogenics is available from the CGA.

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 cryogenic 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 of time. 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 circumstances such as those noted above has not occurred), do not continue to use the unit. Continued use of a cryogenic container that has a vacuum problem can lead to embrittlement and cracking. Further, the carbon steel jacket could possibly rupture if the unit is exposed to inordinate stress conditions caused by an internal liquid leak.

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 cryogenic container has been severely damaged. These are oxygen deficient atmospheres, and exposure to inert gases.

Oxygen Deficient Atmospheres

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

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 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. Life lines 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:

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

Nitrogen

Nitrogen (inert gas) is a simple asphyxiate. This gas will support or sustain life and can produce immediate hazardous conditions through the displacement of oxygen. Under high pressure nitrogen may produce narcosis even though an adequate oxygen supply sufficient for life is present.

Nitrogen vapors in air dilute the concentration of oxygen necessary to support or sustain life. Inhalation of high concentrations of nitrogen can cause anoxia, resulting in dizziness, nausea, vomiting, or unconsciousness and possibly death. Individuals should be prohibited from entering areas where the oxygen content is below 19% unless equipped with a self-contained breathing apparatus. Unconsciousness and death may occur with virtually no warning if the oxygen concentration is below approximately 8%. Contact with cold nitrogen gas or liquid can cause cryogenic (extreme low temperature) burns and freeze body tissue.

Persons suffering from lack of oxygen should be immediately moved to areas with normal atmospheres. SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts worker's skin or eyes, the affected tissue should be flooded or soaked with tepid water (105-115ºF or 41-46ºC). DO NOT USE HOT WATER. Cryogenic burns that result in blistering or deeper tissue freezing should be examined promptly by a physician.

Introduction

General

The ChillZilla LN_2 Liquid Supply System is engineered to supply consistent quality liquid nitrogen for optimum freezing performance. By measuring the liquid parameters, including the temperature inside the tank bottom, the ChillZilla system automatically provides the precise liquid conditions and supply pressure to the application regardless of the tank liquid level.

The Chart model designation for a particular tank can be found on the tank data plate and its associated paper work. The model designation is broken down as Model (VS), Capacity (11000), Inner Material (S), Insulation Type (C), MAWP (175).

Note: *Refer to the Specification section of this manual to see the specific model specification, charts, schematics, and parts covered by the contents of this manual.*

Features

The tanks are designed to provide a convenient, reliable and economical method for the storage and delivery of liquid nitrogen. Important features of these containers include:

- Long-term hold time due to highly efficient multi-layer insulation systems.
- A pressure building system that can be used to increase working pressure during high withdrawal operations.
- A top and bottom fill line that allows the tank to be refilled from a liquid supply unit by either pumping or pressure transfer.
- Simple and convenient piping controls to reduce the number of fittings and components. The control valves are modular units. The fill module has top, bottom and pressure control isolation valves. The pressure control regulator acts as the pressure builder and economizer with a built-in isolation valve. The vent module has a dual safety valve and manual vent valve.

Physical Description

A Chart tank is designed for long-term storage of cryogenic liquefied gases under pressure up to 175 psig (17.6 kg/cm^2). While hardware may vary slightly from model to model, each unit essentially performs the same functions.

The tank is comprised of a stainless steel inner tank encased in an outer carbon steel vacuum shell. The insulation system between the inner and outer containers consists of multiple layers, and high vacuum to ensure long holding time. The insulation system, designed for long-term vacuum retention, is permanently sealed at the factory to ensure vacuum integrity. The units have a tank pressure relief device which is set at the factory. As a secondary pressure relief device, the container is further protected from over-pressurization by a rupture disc. The bursting disc will rupture completely to relieve inner tank pressure in the event the tank relief valve fails and pressure exceeds the rupture disc setting. The vacuum space is protected from over-pressurization by use of a tank annulus rupture disc assembly.

The tanks are leg mounted. Lifting lugs are secured to the bottom head and to the top head of the container. The lifting lugs are provided to facilitate handling. Moving requires the use of a crane and adherence to specific rigging instructions which may vary from vessel to vessel. Some Chart tanks cannot be lifted with only one hook.

Controls used to operate the system are mounted under and on the sides of the customer station. The pressure gauge and liquid level gauge are located at eye level on the container for ease of viewing.

Caution! Tanks are not designed to be moved with liquid in the inner container. Tanks must be drained completely before being lifted or moved.

Caution! To prevent possible tip over, do not leave 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 tank.

Operator Qualifications

Chart tanks are designed for safe and simple operation. The operator is expected to be knowledgable of the nature of the gas(es) with which he is working, as well as all applicable safety requirements. This manual contains several chapters dealing with Installation, Operations, and Maintenance procedures. To fully understand these procedures, we recommend the operator first become familiar with controls and indicators.

Installation

General

This section explains how to unload the tank from the truck or shipping container. It provides the owner with a list of inspections that should be done before receiving the tank and discusses general considerations for the tank's final location.

Site Considerations

Site selection (Per NFPA Bulletins and the CGA)

Prime considerations in choosing a site for the tank are soil stability of the location, accessibility for servicing, and proximity to the gas consumption point. Firm soil conditions are desirable to protect against settling of the facility and possible station damage. The foundation site must also be located such that drainage away from the foundation is ensured. Since the tank will be filled from a truck, it must be readily accessible. Generally, a location adjacent to a parking lot is most suitable.

The site selected should be such that the ChillZilla LN_2 Supply System and associated equipment (if any) will not be beneath or exposed by the failure of electric power lines, flammable or combustible liquid lines, or flammable gas lines. Should the unit be located indoors, the building must be of noncombustible construction, adequately vented, and be used exclusively for gas storage.

Site Preparation

Site preparation considerations include selecting the proper foundation. However, before the foundation is laid the site must be cleared of all organic material and topsoil. In addition, the site soil bearing must be capable of 2000 psf minimum. If this cannot be substantiated, a local professional engineer should be consulted. The construction of a firm base or foundation for the ChillZilla LN_2 Supply System is of prime importance. Most often, this will be concrete; however, steel frames may also be used. In either case, a firm bed consisting of gravel or crushed stone is required for the foundation to rest on.

Concrete Foundations

Concrete pads are the most common foundations on which ChillZilla LN_2 Supply Systems are installed. They provide a highly stable, permanent location for the unit, as well as any on-site support equipment required (reserve cylinders, additional vaporizers, etc.). All exposed parts should be coated with an aluminum paint or equivalent. Skirted pads need only be used if required by the local codes. If used, install as required, but below local frost line.

Site Protection

In many situations, the tank is vulnerable to damage. This may be due to tampering by unauthorized personnel, other equipment moving in the area, or a combination of these situations. Depending on the exposure, protection should be provided by either a fence or pylons or both.

Other Site Considerations

Installation of a Chart tank should be supervised by personnel familiar with their construction and intended use.

Following installation, all field erected piping and tank connection points should be tested at maximum operating pressure to check for leaks.

Note: *If during site preparation any questions arise concerning the foundation, location, etc., it is advised that your local Chart service provider or the factory be consulted.*

Each tank system installed on consumer premises should be inspected annually. Weeds and long dry grasses must be cut back within 15 ft/457 cm of any bulk oxygen storage container

Handling Instructions

Installation of a tank at the storage site requires the use of a lift crane.

Note: *If the pad is not completed when the tank arrives, arrangements should be made to have the unit taken from the truck and stored in a protected area. Store the tank in a horizontal position until it can be placed on a properly constructed pad.*

Figures 1 & 2 depict two methods of handling vessels during installation. The handling method pictures in Figure 1 uses two cranes to place the tank. The two-crane method is safer, and thus the more preferred method of installing the vessel. The alternate method of installation uses a single crane. This method is pictures in Figure 2.

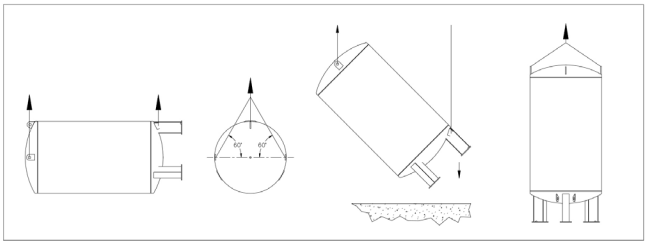


Figure 1 - Two-Crane Installation Method

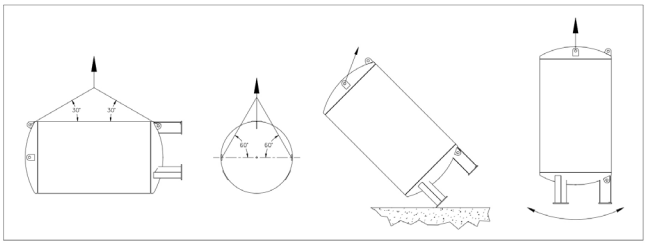


Figure 2 - Single-Crane Installation Method

Unloading

1. Connect to the lifting lug on the top of the tank and on the leg as shown in the rigging illustration.
2. Disconnect any chains, straps, or shipping braces that may have been used to hold the tank to the truck bed.
3. Lift the tank only a few inches and check to make sure there are no additional connections between the tank and the trailer.
4. Remove the tank from the trailer and place it on the pad or designated hold area while the pad is being constructed.

Inspection

A receiving inspection is one of the most important operations in the life of the tank, and should be done thoroughly and conscientiously. Any indications of damage should be immediately reported to the freight company and Chart.

Receiving Checkpoints

1. Check braces, skids, wooden chocks, and other supports shipped with the tank. Damage or deformation would indicate the possibility of mishandling during shipment.
2. Examine welded or brazed joints on plumbing for cracks or deformation. Areas to check in particular are near valves and fittings.
3. Check the area where pipes exit from the tank for cracks or breaks.
4. Check the relief valves and burst discs for dirt damage.
5. Check the pressure in the tank with the pressure gauge (G-1). If pressure is “0” then extra precautions against contamination and impurities must be taken.
6. Examine the 5g impactograph. If it has sprung, damage may have occurred during shipment. Notify your company’s tank specialist and/or Chart.
7. Check the tank vacuum level using the vacuum test procedure.

Vacuum Test Procedure

Caution! Unauthorized changing of the vacuum probe (VR-1) will void vessel warranty.

1. The standard Chart probe is the Hastings DV-6R probe. Select a compatible instrument to match this type of probe.
2. Remove the rubber cap on the probe outlet to expose the contacts. Note that the probe housing need not be removed for this step.
3. Plug the instrument to the probe and calibrate the instrument.
4. Open the vacuum probe isolation valve. Wait for 5 minutes and take and record a vacuum reading.

***Note**: The valve handle protrudes through the protective housing and can be turned without opening the housing.*

5. Close the isolation valve and take a second reading. Monitor the rate of vacuum pressure rise in the vacuum probe with the isolation valve closed. If the vacuum continues to rise at a constant rate, it is possible that the probe assembly is leaking. Consult the factory.
6. Verify that the isolation valve is closed.
7. Replace rubber cap on probe.
8. Compare the vacuum reading obtained now to reading taken prior to shipping.

Vessel Tie Down Guidelines

The following are guidelines for securing a Chart tank for shipping.

- Lay the tank on corrugated cardboard or plastic to prevent damage to the finish.
- The tank should be orientated with the plumbed head pointing backward. The plumbing is less likely to be damaged during shipping in this orientation.
- Place supports or saddles on the head-shell seam. Never in the middle of the head.
- Using appropriately sized chain, tie the tank to the bed of the trailer at the lifting lugs on the top of the tank and at any lug clearly marked “Tie Down Only”.
- Do not attach chains to holes on the leg pad.
- A minimum of six chains should be used to secure any tank. The chains should be situated such that the tank cannot slide or roll in any direction.
- Straps can cause damage to the tank finish. Avoid using straps to secure the tank.
- Under no circumstances should a chain, strap, or other tie down equipment that may damage the tank finish come in direct contact with the outer shell of the tank. Use corrugated cardboard or a similar material to protect the tank in areas where contact may occur.
- All pressure relief devices including rupture disks and relief valves must be adequately protected from road grit using pipe caps or duct tape.
- Protruding assemblies may require separate bracing.

Operations

Filling Procedures

This section provides the purging, initial fill, and refilling procedures for the ChillZilla LN_2 Liquid Supply System. Before performing any of the procedures contained in this section, become familiar with the location and function of the controls and indicators shown in the Specifications section of this manual.

Initial Fill Precautions

The initial fill is usually performed on a warm tank, one that has not been in use for an extended period. The warm container must be purged to ensure product purity.

When preparing the tank for filling or when changing service, the following items should be considered:

- The tank should be inspected for possible damage or unsuitability for intended use. If damage is detected (e.g. serious dents, loose fittings, etc.) remove the unit from service and perform repairs as soon as possible.
- The tank may be filled by pumping or pressure transfer. If tank pressure is at least 50 psi (3.5 kg/cm^2) less than the maximum allowable pressure of the supply unit, liquid may be transferred by pressure transfer. If the normal working pressure of the tank is equal to or greater than the maximum allowable pressure of the supply unit, liquid must be pumped into the tank.
- To remove the moisture or foreign matter from the tank or tank lines, the tank must be purged. Use a small amount of new product for purging when changing service, and a small amount of the same product if the purge is to ensure purity or remove contaminants.
- When changing service, the approved CGA (or other keyed) fitting will have to be installed for connection FC-1.

Purging Procedure

The maximum purge pressure should be equal to 50% of the maximum operating pressure of the tank or 30 psi (2.1 kg/cm^2), whichever is less. The maximum purge pressure should be determined before starting the purge operation. To prevent drawing atmospheric contaminants back into the tank, a positive pressure of at least 5 psi (0.4 kg/cm^2) must always be maintained in the tank.

Attach the source of liquid purge to the fill connection (FC-1).

The following procedure should be used to purge the system:

1. Close all valves except the liquid level gauge vapor phase and liquid phase shutoff valves (HCV-8 & HCV-10).
2. Open hose drain valve (HCV-7), and allow source to vent through hose. Vent until slight frosting appears on hose. Close hose drain valve (HCV-7).
3. Open the bottom fill valve (HCV-1) enough to allow liquid to flow slowly into the tank through the bottom fill line. The gradual flow enables the liquid to vaporize in the line and to slowly build up pressure in the inner tank.
4. Shut off the liquid supply source when the pressure in the tank reaches the maximum purge pressure as indicated on the tank pressure gauge (PI-1).
5. Open the fill line drain valve (HCV-7) slowly to avoid splashing of the liquid. Drain all liquid from the tank. The appearance of gas (vapor) at the drain indicates that all liquid has been drained.
6. Close drain valve (HCV-7) and bottom fill valve (HCV-1).
7. Open the liquid level gauge equalization valve (HCV-9) to prevent damage to the gauge before closing the liquid level gauge vapor phase and liquid phase shut-off valves. When all liquid is drained, close the liquid level gauge vapor phase and liquid phase shut-off valves (HCV-8 & HCV-10).
8. Loosen the unions on either side of the liquid level gauge (LI-1). Both the upper and lower liquid level gauge valves (HCV-8 & HCV-10) should be opened wide and the gas streams visually checked for signs of moisture. Provided no moisture is observed after blowing the lines for approximately two minutes, both valves should be closed. If moisture is observed in the gas stream, the gas should be discharged until it is clear of all moisture.
9. A careful check for moisture in the phase lines will ensure trouble free operation of the liquid level gauge. Due to their small diameter, gauge lines are easily plugged by ice.
10. Open the vapor vent valve (HCV-12) and full trycock valve (HCV-4). The top fill valve (HCV-2) will have to be vented by opening hose drain valve (HCV-7).
11. Repeat purge procedure steps 2 through 6 and 10 at least three times to ensure product purity.

12. Reconnect the liquid level gauge (LI-1), open the liquid level control valves (HCV-8 & HCV-10), then close the by-pass valve (HCV-9).

13. After purging the tank but before filling, verify that the following valves are open or closed as indicated.

Valve	Position
Bottom Fill Valve (HCV-1)	Closed
Top Fill Valve (HCV-2)	Closed
Vapor Vent Valve (HCV-12)	Closed
Full Trycock Valve (HCV-4)	Closed
Liquid Level Gauge Equalizing Valve (HCV-9)	Closed
Liquid Level Gauge Liquid Phase Valve (HCV-10)	Open
Liquid Level Gauge Vapor Phase Valve (HCV-8)	Open

Initial (Warm Tank) Filling Procedure

The following steps are used to fill the storage tank for the first time:

1. Purge tank to assure product purity.

2. Verify that the content of the supply unit is the proper product to be transferred.

3. Verify that all valves except liquid phase-high (HCV-10) and gas phase-low (HCV-8) are closed.

4. Connect the supply unit transfer hose to tank fill connection (FC-1).

5. Cool down the transfer hose prior to filling by opening hose drain valve (HCV-7) and venting the supply unit through the hose for approximately three minutes. Close drain valve (HCV-7).

6. If a **Pressure Transfer** is to be made follow step 7. If a Pump Transfer is to be made follow step 8.

7. Open bottom fill valve (HCV-1) slowly. For Pressure Transfer, allow pressure to build up in the liquid supply unit until it is at least 50 psi (3.5 kg/cm^2) higher than station pressure. Open the discharge valve on the supply unit to begin flow.

8. For **Pump Transfer**, make the required connections to the pump. Open the supply unit transport discharge valve slowly. Maintain pump discharge pressure from 50 psi (3.5 kg/cm^2) to 100 psi (7.0 kg/cm^2) higher than the tank pressure. Fill slowly.

9. Monitor pressure in tank during filling. If pressure rises above supply pressure, or near relief valve pressure, the tank may have to be vented through the vapor vent valve (HCV-12), should pressure continue to rise, the fill may have to be interrupted to allow pressure to drop.

10. Monitor liquid level contents gauge (LI-1). When the gauge indicates approximately 3/4 full, open full trycock valve (HCV-4).

11. When liquid spurts from full trycock valve (HCV-4), immediately stop fill at the supply source and close full trycock valve (HCV-4).

12. Close bottom fill valve (HCV-1).

13. Drain residual liquid in the fill hose via drain valve (HCV-7).

14. Relieve fill hose pressure by loosening the hose at fill connection, and then disconnect the hose. It is recommended that the fill hose be allowed to defrost to prevent moisture from being drawn inside the hose.

Tank Refilling Procedure

Filling a cryogenic tank through the bottom tends to raise pressure in the tank as gases in the vapor space are compressed. Filling through the top tends to lower pressure as gases in head space are cooled down and re-liquefied.

The following steps should be taken to refill the storage tank:

1. Verify that the content of the supply unit is the proper product to be transferred.

2. Verify that the bottom and top fill valves are closed (HCV-1 & HCV-2).

3. Verify minimum required operating pressure in the tank and current tank pressure.

4. Verify that all other valves are in normal operating positions.

5. Connect the supply unit transfer hose to tank fill connection (FC-1).

6. Cool and purge down the transfer hoses prior to filling by opening hose drain valve (HCV-7) and the supply unit discharge valve for approximately three minutes or until hose begins to frost. Close drain valve (HCV-7).

7. Open top fill valve (HCV-2) completely.

8. If a **Pressure Transfer** is to be made follow step 9. If a Pump Transfer is to be made follow step 10.

9. For a Pressure Transfer, allow pressure to build up in the liquid supply unit until it is at least 50 psi (3.5 kg/cm^2) higher than station pressure. Open the discharge valve on the supply unit to begin flow.

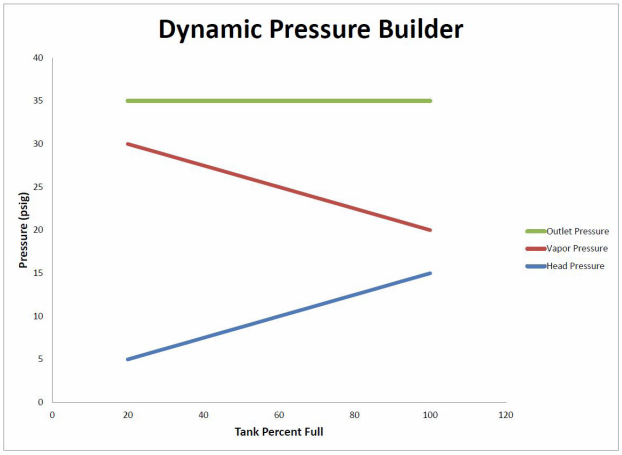
10. For a **Pump Transfer**, make the required connections to the pump. Open the supply unit transport discharge valve slowly. Close pump circulating valve slowly, so as not to lose pump prime. Maintain pump discharge pressure from 50 psi (3.5 kg/cm²) to 100 psi (7.0 kg/cm²) higher than tank pressure.
11. Monitor pressure in tank as indicated. Try to maintain initially noted tank pressure. If pressure begins to drop too much, open the bottom fill valve (HCV-1) and throttle top fill valve (HCV-2) until pressure stabilizes.
12. Monitor liquid level contents gauge (LI-1). When the gauge indicates approximately 3/4 full, open the full trycock valve (HCV-4).
13. When liquid spurts from the full trycock valve (HCV-4), stop fill at the supply source and close the full trycock valve (HCV-4).
14. Close tank fill valves (HCV-1 & HCV-2).
15. Drain residual liquid in the fill hose via drain valve (HCV-7).
16. Relieve fill hose pressure by loosening the hose at the fill connection, and then disconnect the hose.

Withdrawal Procedures

This section provides general guidelines for product delivery in liquid form. Before performing any of the procedures contained in this section, become familiar with the location and function of the controls and indicators.

Pressure Building

The system is designed for continuous operation. As the liquid level drops, the pressure in the tank must increase to keep the product in a liquid state and maintain a constant flow rate. When the pressure drops below a specific value which is calculated by the PLC, the PB inlet electrical valve (EOV-1) will open. This valve allows product to flow through a vaporizing coil with fins (PBC-1). A manifold is used to ensure even distribution. The fins add heat to the liquid and it boils into a gas. This gas is then piped back into the top of the storage tank to increase the pressure. This process continues until the pressure reaches a high enough level, again calculated by the PLC. The PLC will automatically close the PB inlet electrical valve (EOV-1). Once the valve is closed the pressure may rise a small amount as the remaining liquid in the PB coil boils. The Dynamic Pressure Builder chart shows the general change in tank pressure as the liquid level drops for a 15,000 gallon tank.



The ChillZilla system does not come equipped with a mechanical pressure regulator. The pressure in the tank is completely controlled by the PLC. When the tank is full, the pressure will be lower than when the tank is almost empty. The purpose of this operation is to maintain a constant outlet pressure at the bottom of the tank.

The standard tank comes with a pressure building coil attached to the side of the tank. If the pressure builder is operating often ice may start to build up on the fins. The ice lowers the effectiveness of the fins so it must be removed. The only way to safely remove the ice is by allowing the fins to warm above ambient freezing temperatures. For continuous operation where the system will not be shut down, and the fins are allowed to warm, an auxiliary vaporizer may be installed.

Liquid Withdrawal

It is recommended that the liquid withdrawal line be connected to Chart vacuum jacketed piping. The piping will efficiently bring the liquid to the application with the least amount of pressure rise.

Liquid product should be drawn from the tank using the VJ outlet (C-7). It is not recommended that the connection on the bottom fill line (C-3) be used, as this will result in higher losses than required.

Normal liquid withdrawal operations are performed at lower pressures (approx. 50 psig or less) (3.5 kg/cm²) to reduce flash-off losses and splashing. Transfer of liquid at higher pressure can lead to excessive splashing of the cryogenic liquid which could result in substantial product losses. An attached pressure building coil is used to decrease losses and maintain supply pressure. All personnel should be fully instructed in the cautions associated with handling cryogenic fluids and the proper clothing and protective gear to be used.

Controls

Chart cryogenic container operating procedures specify that the operator shall be familiar with all controls and indicators as well as safety considerations. The following controls and indicators should be located and identified on the vessel prior to filling or putting the vessel into operation.

Control Panel

The control panel includes and Allen Bradley PLC and Exor HMI.

The photo below shows the control panel and explains the basic operations of all keys.

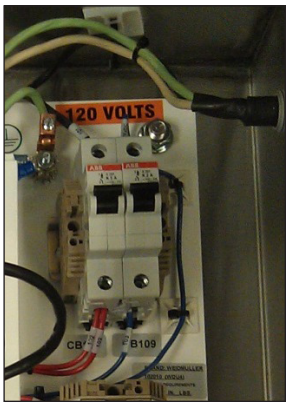
Quick Startup

This section will go through the process to program the ChillZilla system for the first time before operation begins. The system has default parameters that are put in place so the system can operate as soon as it is turned on the first time. These values may not represent your plant setup and may need to be changed. The following steps will go through how to change these parameters so the system can be run in the most efficient way.

Power

The two breakers at the top of the inside of the control panel located under the tank are used to turn the system on and off. The switches below are currently in the ON position.

- Up = ON
- Down = OFF



Control Panel Screens

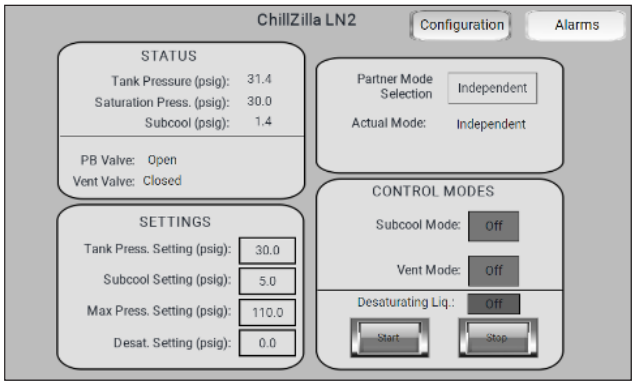


Figure 1 - Unit in Independent (Standalone) Mode

- Partner Mode Selection is the button used to select which mode of operation unit should be in.

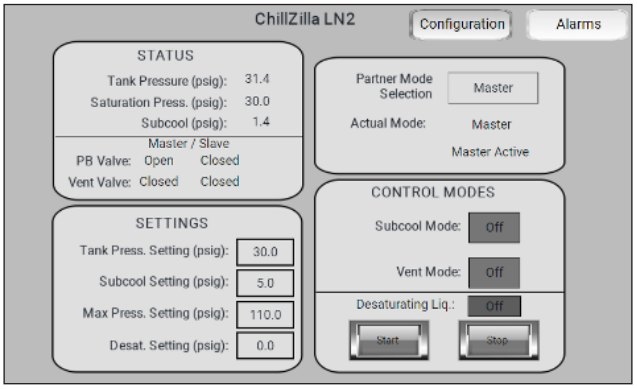


Figure 2 - Unit in Master Mode

- Able to control its valves and the valves of a slave unit
- Actual Mode indicates that communications are good and is actually in Master Mode
- Master Active indicates it's the next unit to PB

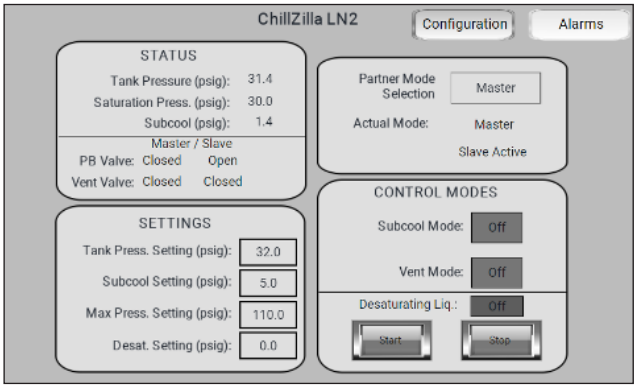


Figure 3 - Unit in Master Mode

- Able to control its valves and the valves of a slave unit
- Actual Mode indicates that communications are good and is actually in Master Mode
- Slave Active indicates the other unit is next unit to PB

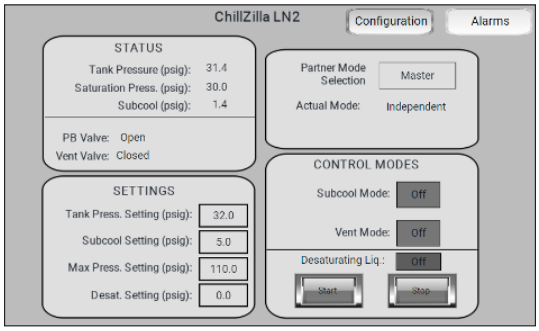


Figure 4 - Unit in Master Mode

- Able to control its valves
- Actual Mode indicates that it is unable to communicate with the slave unit and has fallen back to Independent Mode

Status

- Tank Pressure: Pressure at liquid phase line of tank
- Saturation Pressure: Pressure at saturation bulb in liquid
- Subcool: Amount of subcool in tank based on Tank Pressure – Saturation Pressure
- PB Valve: Status of PB Valve (Shows status of both Master and Slave units' PB Valves when a master unit)
- Vent Valve: Status of Vent Valve (Shows status of both Master and Slave units' Vent Valves when a master unit)

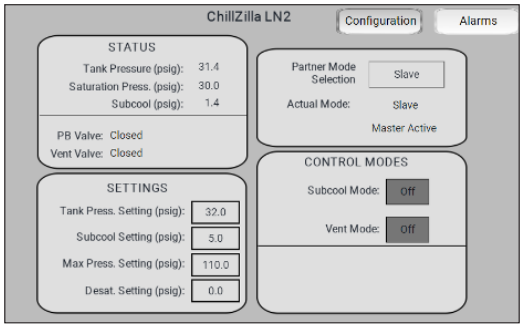


Figure 5 - Unit in Slave Mode

- Actual Mode indicates that it's able to communicate with the Master Unit and in Slave Mode
- Master Unit is next to PB

Settings

- Tank Pressure Setting
  - Begin pressure build if pressure falls below Tank Press. Setting. When in Master/Slave mode, Master unit will alternate between using PB valve on Master unit and Slave unit based on pressure detected at Master Unit.
- Subcool Setting
  - When in Subcool Mode, begin Pressure Build if subcool falls below Subcool Setting. When in Master/Slave mode, Master unit will alternate between using PB valve on Master unit and Slave unit based on pressure detected at Master unit.
- Max. Pressure Setting
  - When in Vent mode, begin to vent unit if Tank Pressure is greater than Max. Press. Setting for 5 seconds. If in Master/Slave mode, open both Vent Valves. Create an alarm if pressure in tank rises above Max. Press. Setting for more than 30 SECONDS.
- Desat. Setting
  - Tank Pressure to desaturate to when performing a manual Tank Desaturation
- Partner Mode Selection Button
  - User Selects if unit is Independent, Master or Slave
- Actual Mode
  - What mode of operation the unit is actually in Independent, Master or Slave.
    - Independent — Standalone Chillzilla
    - Master — Two Chillzilla units in parallel with liquid and vapor spaces tied together. Master unit will decide when units should Pressure Build or vent. Unit will fall back to Independent when communications are down.
    - Slave — Two Chillzilla units in parallel with liquid and vapor spaces tied together. Slave unit will take direction from Master unit on when to Pressure Build or Vent. Unit will fall back to Independent when communications are down.
- Master Active/Slave Active
  - Which unit will Pressure Build next when in Master/Slave mode.

Control Modes

- Subcool Mode — Unit will Pressure Build if Subcool ever drops below Subcool setting. When enabled,the system will calculate the necessary pressure to deliver saturated liquid to the plant. When disabled, the system will maintain a desired pressure at the liquid outlet.
- Vent Mode — Unit will Vent if Tank Pressure is ever greater than Max Press. setting in order to maintain a pressure within desired specs.
- Stop Button — Manually stops Desaturation of Liquid
- Configuration Button — Loads Configuration page
- Alarms Button — Loads Alarms page

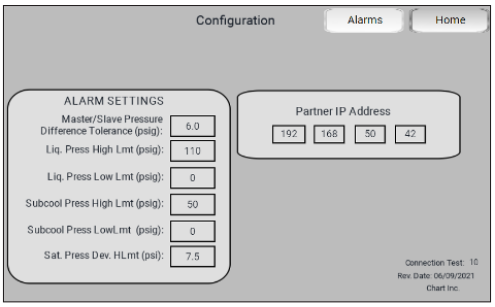


Figure 6 - Configuration

- Allowable differential between Master and Slave Units.
- Liq Press High Lmt — High limit alarm
- Liq Press Low Lmt — Low limit alarm
- Subcool Press High Lmt — High Subcool limit alarm
- Subcool Press Low Lmt — Low Subcool limit alarm
- Sat. Press Dev. HLmt — Allowable differential between Master and Slave Units for subcool
- Partner IP Address — IP address only visible if set to Master of the Slave unit. Must be entered on Master Unit

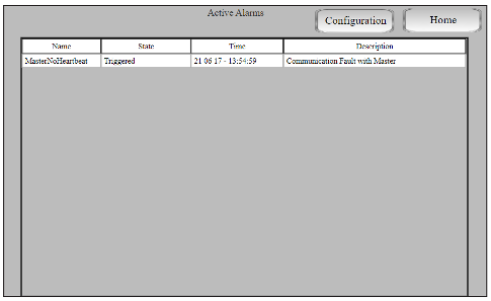


Figure 7 - Active Alarms

- Name — Name of Active Alarm
- State — State of Alarm
- Time — Time when triggered
- Description — Description of Alarm

Maintenance

This section contains ChillZilla LN_2 Supply System maintenance information including troubleshooting and repair procedures. Before performing any of the procedures in this section, be sure you are familiar with the location and function of controls and indicators discussed in other sections of this manual.

Compatibility and Cleaning

It is essential to always keep the vessel clean and free of grease and oil. This is particularly important for units used in nitrogen service since the temperature of liquid nitrogen is below the liquefaction temperature of air; thus making it possible to condense liquid oxygen from air on the piping and vaporizer surfaces.

Replacement components should be compatible with liquid oxygen and have been properly cleaned for oxygen service (Refer to CGA Bulletin G4.1 “Equipment Cleaned for Oxygen Service”). Do not use regulators, fittings, or hoses that were previously used in a compressed air environment. Only oxygen compatible sealants or virgin Teflon tape should be used on threaded fittings. All new joints should be leak tested with oxygen compatible leak test solution. Use a suitable solvent for cleaning and de-greasing metallic parts.

Periodic Inspection

In order to maintain a cryogenic tank in good operating condition, certain system components should be inspected on a periodic basis. Those components requiring periodic inspection are listed in this manual. In tanks being operated in areas having extreme hot or cold climates, inspection intervals should be shortened.

Pressure Bulb

A pressure bulb is used to estimate the saturation pressure of the stored liquid. A pressure bulb operates by having a capped pipe filled with vapor in the middle of the storage liquid. The surrounding liquid cools the pipe and the vapor condenses inside. The pressure inside the pipe is the saturation pressure of the stored liquid. Over time the pressure bulb may leak and need to be repressurized. If the pressure bulb does lose pressure, the system will build excessive pressure in the tank. If this occurs turn subcool mode off until the bulb can be re-pressurized.

The pressure bulb can be re-pressurized on-site using the tank. The following steps should be taken to re-pressurize the pressure bulb.

1. Open the electronics control box under the tank.
2. Check the saturation pressure reading. If it is below 10 psig the bulb needs to be repressurized.
3. Open temperature bulb valve (HCV-27) for 10 seconds to allow gas product to flow into the bulb.
4. After 10 seconds or when the pressure stops changing close the temperature bulb valve (HCV-27).
5. Check the saturation pressure reading. If the bulb does not hold pressure after being re-pressurized there may be a leak and service may be needed.

Soldering

Before performing any soldering work, always exhaust oxygen from oxygen lines and purge with nitrogen gas. Verify that lines are inert.

Vacuum Integrity

ChillZilla LN_2 Liquid Supply Systems are equipped with vacuum thermocouple gauge tubes and vacuum integrity may be tested with a vacuum meter. Deterioration or loss of vacuum will be apparent by cold spots, frost, or condensation on the jacket, or evidenced by abnormally rapid pressure buildup. Unless one of these conditions is evident, the vacuum level should not be suspected. In the event one of the above conditions exist, contact the factory for advice on vacuum testing.

Storage

When a tank is to be removed from service, it is essential to maintain cleanliness of the internal piping and pressure tank. Follow the withdrawal procedures to empty the tank of product and purge prior to storage. It is recommended to set up a routine inspection schedule to ensure a minimum positive pressure of 5 psi is maintained in the tank during storage. Ensure all atmospheric ports remain capped, plugged, or otherwise sealed to prevent moisture or debris ingress.

Troubleshooting

The table below provides some troubleshooting procedures. The table is arranged in a Trouble/Probable Cause/Remedy format. Note that probable causes for specific problems are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next. Repair procedures required, as listed in the remedy column, may be found in the Repair portion of this section. Perform procedures in the order listed and exactly as stated (Refer to drawings as required to locate system components identified in the troubleshooting guide.)

Trouble	Probable Cause	Remedy
Excessive tank pressure (tank vents through relief valve frequently)	Tank was just filled with higher pressure (warm) liquid	Vent pressure (HCV-12) to re-stabilize at a lower pressure
	Excessive shutdown time or low withdrawal rate	NER is greater than use rate. Vent tank properly to desired operating pressure
	Vent Valve (EOV-2) inoperable	Repair/Replace Electronic Valve (EOV-2)
	Tank pressure gauge (PI-1) in error.	Confirm tank pressure with calibrated test gauge. If wrong replace defective gauge.
	Inadequate vacuum	Refer to "vacuum loss" in Trouble column
Cannot pressure transfer liquid adequately	Pressure below 20 psi	Check pressure building circuit
Failure to maintain tank pressure	Relief valve (PSV-1) leaking or frozen open	Refer to "Leaking safety relief valve" in Trouble column
	Piping leak	Soap test and repair
	Low liquid level	Refill tank
	Excessive withdrawal rate	Consult factory (Chart)
	PB valve (EOV-1) inoperable	Repair/Replace Electronic Valve (EOV-1)
Vacuum loss	Annular space relief device is open	Inner tank or piping leak. Remove all product from the container and return to Chart
	Leak in the O-ring seal of annular space relief device	Remove all product from the container and return to Chart
	Sweat or frost appears on outer tank, indicating marginal vacuum levels	Perform an NER test on the container. If unsatisfactory, return to Chart
Erratic or erroneous contents gauge readings	Leaking gauge lines	Soap test and repair leak
	Gauge needle is stuck	Lightly tap gauge. If this fails to correct the problem, inspect the needle and bend slightly, if necessary
	Needle is not zero adjusted	Refer to Gauge Adjustment
	Gauge damaged or faulty	Replace gauge
Leaking safety relief valve (PSV-1A/B)	Dirt or ice under seat	Re-seat or replace valve as required
	Valve improperly seated	Re-seat or replace valve as required
	Damaged seat	Replace valve
Ruptured tank bursting disc (PSE-1A/B)	Excessive tank pressure	Replace disc
	Atmospheric corrosion and/or fatigue	Replace disc
	Interior corrosion	Replace disc after blowing out line
	Defective disc	Replace disc

Trouble	Probable Cause	Remedy
Saturation pressure reading incorrectly	Pressure bulb is not pressurized	Re-pressurize pressure bulb
	Pressure bulb is leaking	Consult factory (Chart)
	Cable break	Check wiring
	Sensor is defective	Repair/Replace sensor
Tank pressure sensor (PS-2) reading incorrectly	Cable break	Check wiring
	Sensor is defective	Repair/Replace sensor

Repair

Caution! Plumbing should always be allowed to return to ambient temperature before repair work is performed. Vent or drain the system as necessary before replacing any component(s) exposed to pressure or to cryogenic liquid.

When repair of damaged components is required (in those instances when a spare part is not readily available), follow the instructions below.

When disassembly of an assembly is required, removed parts should be coded to facilitate reassembly. Reassembly of components should always be performed in the reverse manner in which they are disassembled. Parts removed during disassembly should be protected from damage, thoroughly cleaned, and stored in protective polyethylene bags if not immediately reinstalled. Clean all metal parts with a good industrial cleaning solvent. All rubber components should be washed in a soap and warm water solution. Air dry all cleaned parts using an oil-free, clean, low-pressure air source. Before reassembly, make sure that all parts are thoroughly cleaned and have been degreased. Cleaning will prevent valves and regulators from freezing while in service and prevent contamination of the liquid product.

After removing components plug pipe openings as soon as possible to prevent contamination. Plastic pipe plugs of a clean plastic film may be used for this purpose.

Valve Repair

When a defective valve is suspected, remove and repair the assembly as described in this manual. If a valve is leaking through the packing, tighten the packing nut first to see if the leakage will stop before removing the valve. The packing is best tightened when the valve is warm. If a safety relief valve fails, the defective assembly should be discarded and a new valve installed. Refer to the steps below for valve repair procedures.

Note: *Globe valves used on containers vary in size from 1/4" to 2". While internal valve components may vary from valve to valve, the functional operation and repair procedures for these valves are the same.*

Note: *Unless valve component parts are available in inventory, a defective valve should be replaced with a new assembly.*

1. Release pressure in the tank by opening vent valve HCV-12.
2. Remove the valve seat assembly.
3. Disassemble the valve and inspect all piece parts.
4. Clean all metallic parts with a good industrial cleaner, and all rubber & Teflon parts in a warm water and soap solution.
5. Air dry all components using a clean low pressure air source.
6. Replace all worn, deformed or damaged parts.
7. Repack the valve. Either preformed or twisted Teflon filament packing can be used. When using twisted Teflon filament packing untwist Teflon and use only a single strand. Pack Teflon tightly; otherwise moisture can get into the valve and freeze when the valve is cold.

8. Reassemble the valve. Make sure that mating surfaces are clean and properly seated. If the repaired valve is not to be reinstalled immediately, seal it in a polyethylene bag for storage. Apply a label to the bag such as "CLEAN VALVE. DO NOT OPEN BAG UNLESS UNIT IS TO BE INSTALLED".

Gauge Repairs

It is advised that a defective gauge be replaced with a new unit and return the defective one to your local Chart distributor or to the factory for repairs. This is because a special instrument is normally required for making gauge repairs. However, before replacing gauges there are a number of checks that can be performed.

Caution! Before removing (or calibrating) the tank pressure gauge or liquid level gauge, make sure gauge isolation valves (HCV-8 & HCV-10) are closed and that the equalizing valve (HCV-9) is open.

The major cause of gauge malfunction is a leakage in the gauge line. Therefore, as a first check, make certain that gauge lines are leak tight. Other gauge tests include:

1. Check gauge lines for obstructions.
2. Check leaky equalizer valve.
3. Ensure that connection lines are properly mated.
4. Verify that the gauge is properly zeroed.
5. Ensure that the pointer doesn't stick.

If the above checks fail to correct the problem, remove and replace the gauge. When returning the gauge to Chart for repair, indicate the nature of the difficulty experienced with the gauge in your letter of transmittal.

Inner Tank Burst Disc Repair

The tank burst disc is a safety relief device that will rupture completely to relieve inner tank pressure in the event tank relief valve fails or is unable to accommodate sufficient flow. Due to changes in pressure in the tank, the disc will flex, gradually harden, embrittle, and consequently rupture at a lower pressure.

The steps below describe replacement of the inner tank burst disc for tanks equipped with a dual relief system. In the event that a component needs to be replaced in the dual relief system, simply switch the selector handle to the other side of the safety system to allow routine maintenance and repair.

1. Switch selector valve (HCV-15) to other side, and depressurize the isolated side of the relief valve system rather than venting vessel.
2. Remove burst disc (PSE-1).
3. Install new burst disc (PSE-1), making sure that mating surfaces are clean and properly seated. Use an oxygen compatible liquid thread sealant to prevent leaking.

Testing After Repair

After making repairs requiring disassembly or part replacement, leak test all valves and piping joints that were taken apart and reconnected. Do not return the vessel to service until all leaks have been corrected or retested.

Specifications

The following tables contains the specific engineering specifications for the models covered by this manual.

Model	Gross Capacity		Net Capacity		MAWP*		Diameter		Height		Weight**		NER %/day
	Gal	Liters	Gal	Liters	psig	bar	in	mm	in	mm	lbs.	kg	in O_2
VS-9000CZ	9,354	35,410	8,990	34,031	175	12.1	114	2,896	398	10,109	32,100	14,560	.16
VS-11000CZ	11,410	43,192	10,960	41,438	175	12.1	114	2,896	457	11,608	37,900	17,191	.16
VS-13000CZ	13,470	50,989	13,060	49,437	175	12.1	114	2,896	516	13,106	44,300	20,094	.16
VS-15000CZ	15,520	58,750	15,060	57,008	175	12.1	114	2,896	575	14,605	50,600	22,952	.16

*MAWP - Maximum Allowable Working Pressure.
**Weights are for ASME designs
NER - Normal Evaporation Rate

System Requirements

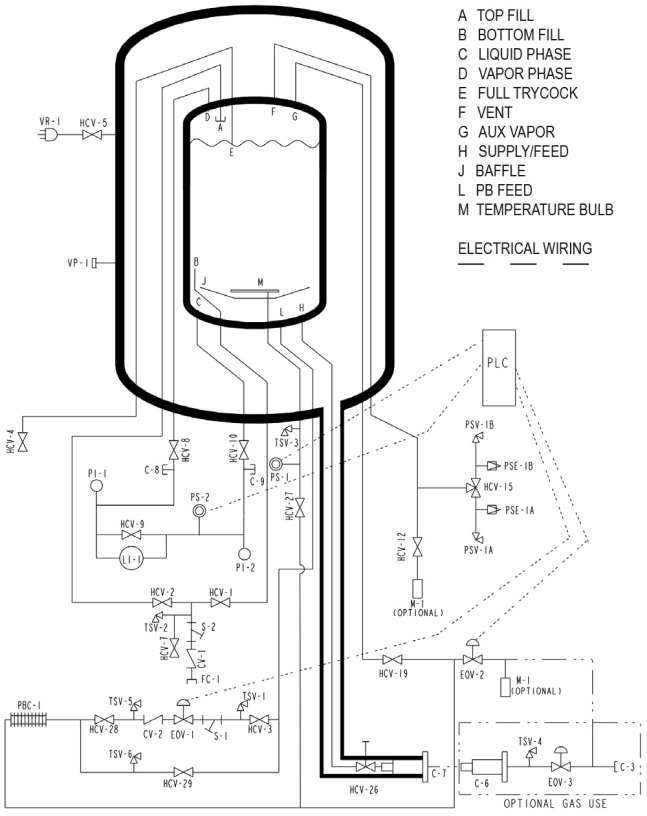
- PLC: 120 VAC/1Ph/60Hz

  15 Amp

Options

- 2” VIP supply line and valve for 40 gpm flow (300’ VIP + 5 elbows + 2 valves = 2 psi pressure drop)
- 40 gpm PB coil
- Vent muffler
- Gas use conversion assembly
- Redundant fill valves

Schematic



Nomenclature

C-7	Liquid Feed FBayo VJ
C-8	Telemetry Tap GPL
C-9	Telemetry Tap LPH
CV-1	Check Valve, Fill Line
CV-2	Check Valve, PB Coil Feed
EOV-1	Electric Actuated Valve PBC-1
EOV-2	Electric Actuated Valve Vent
FC-1	Connection Fill
HCV-1	Valve, Bottom Fill
HCV-2	Valve, Top Fill
HCV-3	Valve, PB Inlet
HCV-4	Valve, Full Trycock
HCV-5	Valve,Vacuum Gauge Tube
HCV-7	Valve, Fill Line Drain
HCV-8	Valve, LI-1 Vapor Phase
HCV-9	Valve, LI-1 Equalization
HCV-10	Valve, LI-1 Liquid Phase
HCV-12	Valve, Vapor Vent
HCV-15	Valve,Safety Relief Selector
HCV-19	Valve, Aux Vapor
HCV-26	Valve, Liquid Feed, VJ
HCV-27	Valve, Temperature Bulb
HCV-28	Feed Valve PBC-1
HCV-29	Feed By-Pass Valve PBC-1
LI-1	Level Indicator, Inr Ves
M-1	Muffler (optional)
PI-1	Pressure Indicator Gauge (Gas)
PI-2	Pressure Indicator Gauge (Liquid)
PLC	Programmable Logic Controller
PBC-1	Pressure Build Coil
PS-1	Pressure Sensor,Temp Bulb
PS-2	Pressure Sensor, Inr Vessel
PSE-1A	Pressure Safety Element, Inner Vessel
PSE-1B	Pressure Safety Element, Inner Vessel
PSV-1A	Pressure Safety Valve, Inner Vessel
PSV-1B	Pressure Safety Valve, Inner Vessel
S-1	Strainer, EOV-1
S-2	Strainer, Fill Line
TSV-1	Thermal Relief, PB Circuit
TSV-2	Thermal Relief, Fill Line
TSV-3	Thermal Relief Temp Bulb
TSV-5	Thermal Relief, PB Circuit
TSV-6	Thermal Relief, PB Circuit
VP-1	Vacuum Port
VR-1	Vacuum Readout
GAS USE OPTION	
C-3	Gas Use
C-6	Gas Use MBayo VJ
EOV-3	Electric Actuated Valve Gas Use Option
TSV-4	Thermal Relief Gas Use Option

Accessories

Pressure Builder Bypass

The pressure builder bypass option is a bypass that would allow flow into the pressure building coils and bypassing the PB Inlet Electrical Valve (EOV-1). The purpose of this is so maintenance can be performed on the PB inlet electrical valve without a halt in product delivery. Without the bypass option the pressure building circuit needs to be shut down and allowed to warm before any maintenance can be performed. This option is built-to-order and needs to be requested before construction of the tank begins. For additional information refer to the Pressure Building section of this manual.

Additional Vaporizer

The additional vaporizer option allows for the addition of a secondary pressure building coil. For applications with continuous operation ice can build up on the fins of the pressure building coils. The only way to get rid of this build up is to allow the fins to warm. With the addition of a secondary pressure building coil the flow can be switched from one coil to the other. This would allow the first coil to warm and melt off the ice. Then the flow can be switched back to the first coil. The additional vaporizer would be installed next to the tank on the ground near the original pressure building coil. The tap for this additional vaporizer (C-6) is located just before the pressure building coil (PBC-1).

SCADA Control

The control box may be connected to the customer's Ethernet network for monitoring data via Modbus TSP/IP or CIP.

Muffler Option

The muffler option allows for the addition of mufflers (M-1) to vents on the tank. If the tank is installed in an area where sound levels are of concern mufflers can be installed to reduce noise from venting product.

Parts List

Ref. No.	Valve No.	Description	Chart PN
1	C-1	Connection, Aux Liquid	N/A
2	C-2	Connection, Aux Vapor	N/A
3	C-3	Connection, Secondary Aux Liquid	N/A
4	C-4	Connection, Secondary Aux Vapor	N/A
5	C-6	Connection, Secondary PB Coil Feed	N/A
6	C-7	Connection, VJ Feed	20552263
7	C-7	Connection, VJ Feed 180°	20561715
8	C-8	Connection, Telemetry Tap GPL	N/A
9	C-9	Connection, Telemetry Tap LPH	N/A
10	CV-1	Fill Line Check Valve	11835855
11	CV-2	PB Feed Check Valve	11656072
13	EOV-1	PB Inlet Electrical Valve	14413113
14	EOV-2	Vent Electrical Valve	20570723
15	FC-1	Fill Connection	10821005
16	HCV-1	Bottom Fill Valve	11835855
17	HCV-2	Top Fill Valve	11835855
18	HCV-3	PB Inlet Valve	10528319
19	HCV-4	Full Trycock Valve	11368257
20	HCV-5	Vacuum Gauge Tube Valve	10482381
21	HVC-7	Fill Line Drain Valve	11835855
22	HCV-8	LI-1 Vapor Phase Valve	10907239
23	HCV-10	LI-1 Liquid Phase Valve	10907239

Ref. No.	Valve No.	Description	Chart PN
24	HCV-12	Vapor Vent Valve	11373021
25	HCV-15	Safety Relief Selector Valve	11492186
26	HCV-19	Aux Vapor Valve	10528319
27	HCV-26	Liquid Feed/Supply Valve	20565219
28	HCV-27	Temperature Bulb Valve	10511218
29	HCV-28	PB Feed Inlet Valve	10528319
30	HCV-29	PB Feed By-Pass Valve	10528319
31	M-1	Muffler	20558886
32	PBC-1	Pressure Building Coil	20552262
33	PI-2	Pressure Indicator Liquid Side	10700596
34	PLC	Control Panel ChillZilla LN_2	21737086
35	PS-1	Pressure Sensor Temperature Bulb	11895567
36	PS-2	Pressure Sensor Inner Vessel	11895567
37	PSE-1A	Pressure Safety Element, Inner	11509291
38	PSE-1B	Pressure Safety Element, Inner	11509291
39	PSV-1A	Pressure Safety Valve, Inner	14163345
40	PSV-1B	Pressure Safety Valve, Inner	14163345
41	S-1	Strainer, PB Feed (EOV-1)	4910142
42	S-2	Strainer, Fill	11835855
43	TSV-1	PB Circuit Relief	1811752
44	TSV-2	Fill Line Thermal Relief	1811752
45	TSV-3	Temperature Bulb Thermal Relief	1811752
46	TSV-5	PB Circuit Thermal Relief	1811752
47	TSV-6	PB Circuit Thermal Relief	1811752
50	VP-1	Vacuum Port	10826172
51	VR-1	Vacuum Readout	4210049
52	HCV-9	LI-1 Equalization Valve	10907239
53	HCV-9	LI-1 Equalization Valve	11939013
54	LI-1	Inner Vessel Level Indicator	13541826
55	LI-1	Inner Vessel Level Indicator	13541834
56	LI-1	Inner Vessel Level Indicator	13541834
57	LI-1	Inner Vessel Level Indicator	13771023
58	LI-1	Inner Vessel Level Indicator	13771031
59	LI-1	Inner Vessel Level Indicator	13771031
60	LI-1	Inner Vessel Level Indicator	11652101
61	LI-1	Inner Vessel Level Indicator	11701620
62	LI-1	Inner Vessel Level Indicator	11701638
63	LI-1	Inner Vessel Level Indicator	11679426
64	PI-1	Inner Vessel Pressure Indicator	10700596
65	PI-1	Inner Vessel Pressure Indicator	11758677

Liquid Level Charts

Liquid level charts are available upon request by emailing Chart's tech service team at techservicemn@chartindustries.com.

Wiring Schematic

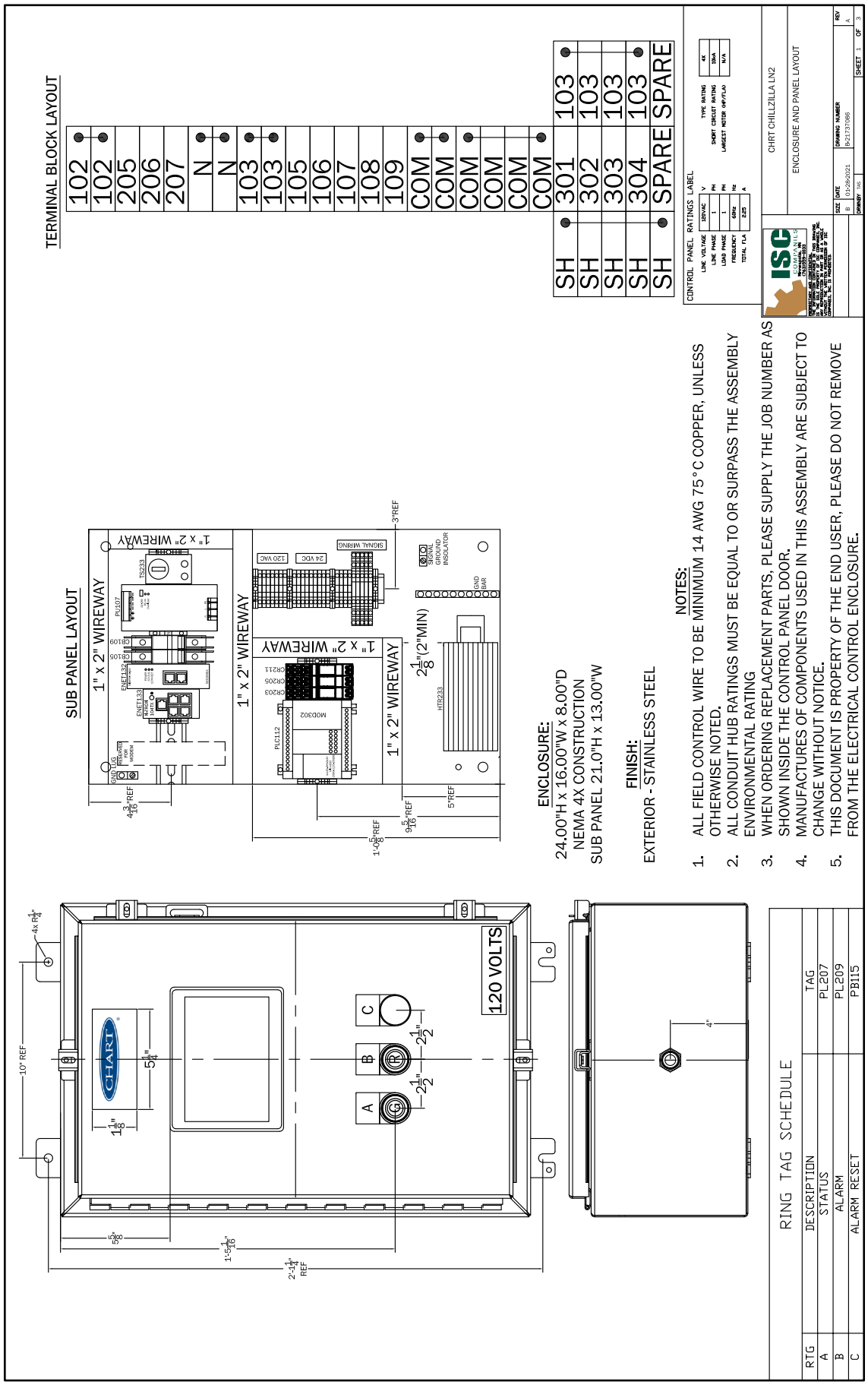
Wiring schematics follow this section of the paper version of the manual and are also available on Chart's Website.

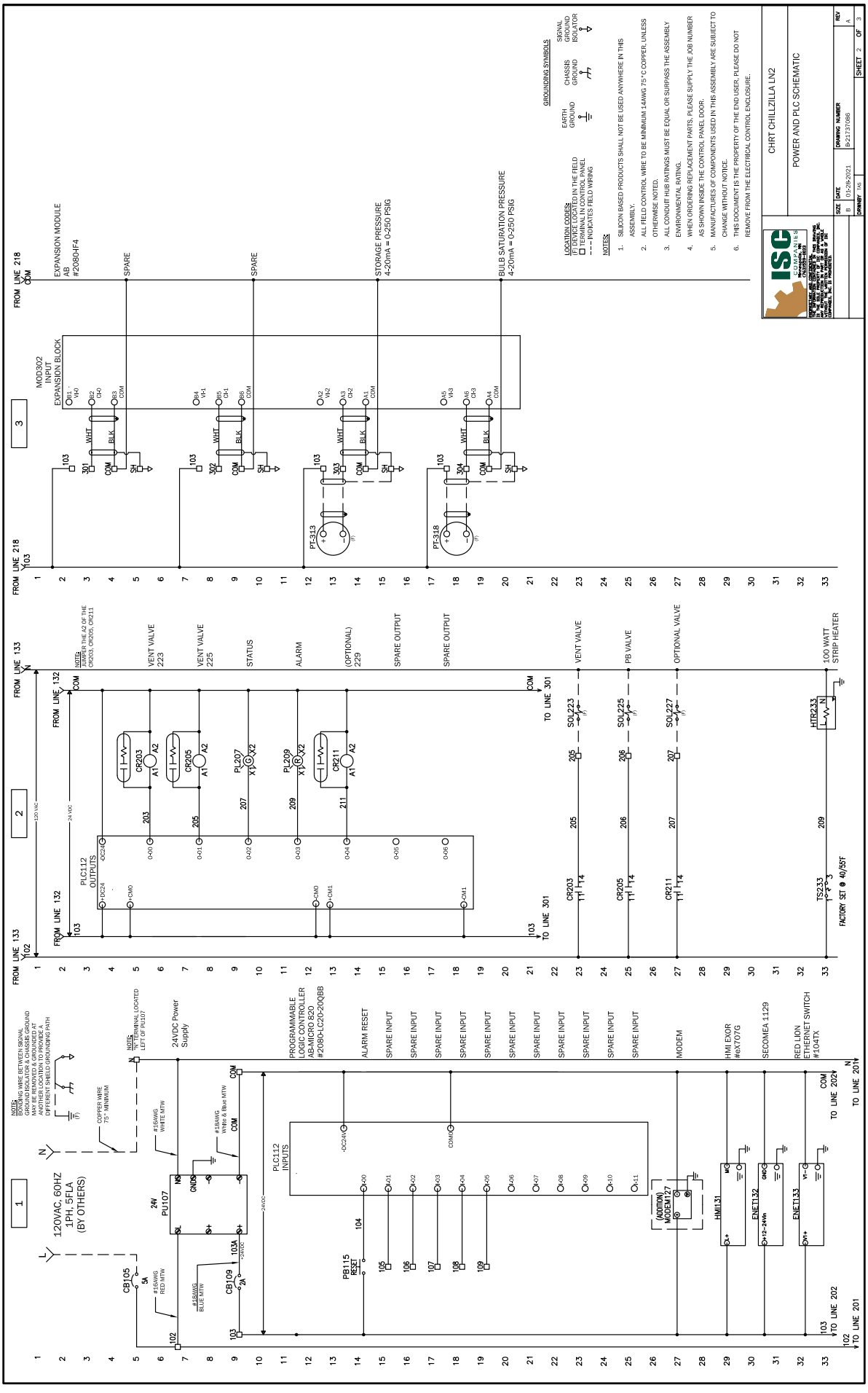
Drawings

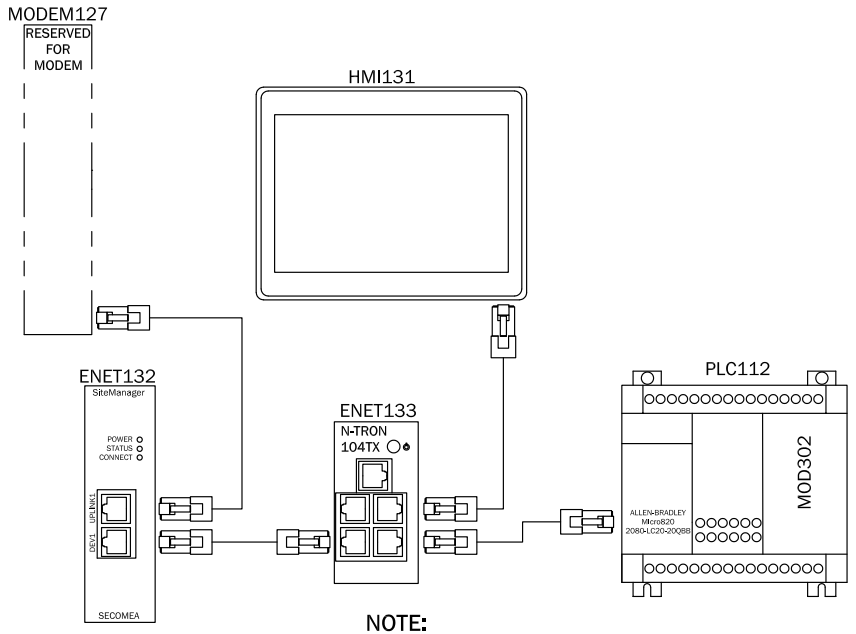
Model	O & D Drawing No.
VS-11000	C-20570098
VS-13000	
VS-15000	

Model	P&ID Drawing No.
VS-11000	
VS-13000	
VS-15000	

Wiring Schematics




CHRT CHILLZILLA LN2
POWER AND PLC SCHEMATIC
ISC
INDUSTRIAL SERVICE COMPANIES
DRAWING NUMBER
B-21737086
DATE
01-28-2021
SHEET 2 OF 3
REV A
120VAC, 60HZ 1PH, 5FLA (BY OTHERS)
24VDC Power Supply
PROGRAMMABLE LOGIC CONTROLLER AB-MICRO 820 #2080-LC20-20QBB
PLC112 INPUTS
PLC112 OUTPUTS
MOD302 INPUT EXPANSION BLOCK
EXPANSION MODULE AB #2080-IF4
PT-313
PT-318
VENT VALVE 223
VENT VALVE 225
STATUS
ALARM
(OPTIONAL) 229
SPARE OUTPUT
SPARE OUTPUT
VENT VALVE
PB VALVE
OPTIONAL VALVE
100 WATT STRIP HEATER
SPARE
SPARE
STORAGE PRESSURE 4-20mA = 0-250 PSIG
BULB SATURATION PRESSURE 4-20mA = 0-250 PSIG
ALARM RESET
MODEM
HMI EXOR #6X707G
SECOMEA 1129
RED LION ETHERNET SWITCH #104TX
GROUNDING SYMBOLS
EARTH GROUND
CHASSIS GROUND
SIGNAL GROUND ISOLATOR
LOCATION CODES
DENOTES LOCATION IN THE FIELD
DENOTES LOCATION IN CONTROL PANEL
--- INDICATES FIELD WIRING
NOTES
1. SILICON BASED PRODUCTS SHALL NOT BE USED ANYWHERE IN THIS ASSEMBLY.
2. ALL FIELD CONTROL WIRE TO BE MINIMUM 14AWG 75°C COPPER, UNLESS OTHERWISE NOTED.
3. ALL CONDUIT HUB RATINGS MUST BE EQUAL OR SURPASS THE ASSEMBLY ENVIRONMENTAL RATING.
4. WHEN ORDERING REPLACEMENT PARTS, PLEASE SUPPLY THE JOB NUMBER AS SHOWN INSIDE THE CONTROL PANEL DOOR.
5. MANUFACTURES OF COMPONENTS USED IN THIS ASSEMBLY ARE SUBJECT TO CHANGE WITHOUT NOTICE.
6. THIS DOCUMENT IS THE PROPERTY OF THE END USER, PLEASE DO NOT REMOVE FROM THE ELECTRICAL CONTROL ENCLOSURE.



NOTE:

1. ALL NETWORK CABLE TO BE RJ45
2. TOP PORT OF ENET132 RESERVED FOR MODEM OR CUSTOMER LAN

LOC	MFG P/N	MFG	DESCRIPTION	TAG	QTY
1	SPN4SS-24168-769	Schaefer	Enclosure Type 4X 24x16x8" Stainless, With Latches		1
2	SPP-2416	Schaefer	Back Panel		1
3	EXDBM20SS6	Hoffman	Enclosure Stainless Drain		1
4	UMBW-4D1-2	WEG	C.B. 2A 1-POLE UL489 "D-CURVE"	CB109	1
5	1606-XLS80E	AB	DC Power Supply 50W	PU107	1
6	UMBW-4D1-5	WEG	C.B. 5A 1-POLE UL489 "D-CURVE"	CB105	1
7	eX707G	Exor	7" HMI	HMI131	1
8	N/A	N/A	CUSTOMER SUPPLIED	MODEM127	1
9	104TX	Red Lion	5-Port Ethernet Switch	ENET133	1
10	SECOMEA1129	Secomea	SiteManager 11xx/33xx Series	ENET132	1
11	CAT5E CABLE 5FT		Cat5 Cable 5ft (HMI to Switch to PLC)		4
12	2080-LC20-20QBB	AB	Micro820 PLC 12Inputs , 7 24 DC Source Outputs	PLC112	1
13	2080-IF4	AB	4-20mA Analog Input Module	MOD302	1
14	FVLU24LG-PLLGN	C3	30mm Indicator Light LED 24vdc Green	PL207	1
15	FVLU24LR-PLLRD	C3	30mm Indicator Light LED 24vdc Red	PL209	1
16	M22-D-X	Eaton	Push Button Base	PB115	1
17	M22-K10	Eaton	NO Contact Block		1
18	M22-XD-B-GB14	Eaton	Blue Lens "RESET"		1
19	600V-Kit		600v Standoff Insulator Kit		1
20	788-312	Wago	RELAY DPDT 8AMP/POLE 24VDC WITH LED	CR203, CR205, CR211	3
21	788-113	Wago	Jumper, 2-Way; Insulated		6
22	FLH-100	Pfannenburg	100W Radiant Cartridge Heater	HTR233	1
23	FLZ-510	Pfannenburg	Adjustable Thermostat 32-140dF Form C Relay	TS233	1
24	2002-3231	Wago	WAGO TRI-DECK SENSOR BLOCK 20A 12-22AWG (L/L/L)		5
25	2002-1201	Wago	WAGO TB 20A 12-22AWG 600V GREY 1/1		19
26	2002-1291	Wago	WAGO END PLATE GREY FOR 2002-12**		3
27	2006-1201	Wago	WAGO TB 50A 8-20AWG GREY 1/1		1
28	2006-1291	Wago	WAGO END PLATE GREY FOR 2006-1		1
29	2002-410	Wago	WAGO TOPJOB 10-POLE JUMPER		1
30	Z5.522.8553.0	Weiland	Din Rail Clamp		8
31	TYD1X2NPW6	Thomas & Betts	1X2 NARROW SLOT WHITE DUCT		3
32	TYD1CPW6	Thomas & Betts	WIREWAY COVER, 1" WIDE, WHITE		3
33	GBK10	EATON	GROUND BAR, 10 TERMINAL		1
34	OMEGA 3FD	Omega	Din Rail		1
35	TA6S	Ilsco	Ground Lug		2
36	88903 (4117540)	Cembre	Ratings Label 52x107mm White		1
37	49194N (4112241)	Cembre	Legend Plate 15x49mm White		7
38	88905 (4117555)	Cembre	Legend Plate 25x100mm White		1

ISC COMPANIES
Minneapolis, MN
(763)559-9003

CHRT CHILLZILLA LN2

NETWORK DIAGRAM & BOM

SIZE	DATE	DRAWING NUMBER	REV
B	01-28-2021	B-21737086	A

DRAWN BY TAS

SHEET 3 OF 3