Product Manual

Phase Separator

Designed and Built by:

Chart Inc.

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San Jose, CA 95134 USA
(800) 371-3303

Part Number 4900 Rev. A

Contents

Revision Log

Revision Level	Date	Description
A	11/06/2014	Original

Preface

General

Stainless steel, vacuum insulated vessels designed to store liquid nitrogen under atmospheric pressure. Phase separators are used in specialized applications requiring extremely high quality, low pressure liquid nitrogen on demand. The level of liquid nitrogen inside is controlled electronically via a pressure differential system. The reservoir is vented to atmosphere. This results in a volume of pure saturated liquid nitrogen. Chart's phase separator is a vacuum insulated reservoir holding tank for liquid nitrogen.

Typical applications include both direct feed or closed loop systems. A closed loop system is typically used to feed a cryopanel in an MBE (molecular beam expitaxy) application. Dynamic or static Chart pipes are used to feed liquid nitrogen into the phase separator. Specialty triaxial pipe delivers pure liquid nitrogen for the phase separator to the application tool inlet.

Features

- Differential Pressure Controls and Proportional Inlet Valve - tried and proven method to maintain a constant level of cryogenics
- Ready Supply of Pure Liquid - mandatory for critical applications, testing, and processes
- High Volume Phase Separators - for custom applications requiring more capacity
- Dynamic and Static Pipe Compatible - available in both dynamic and static vacuum design
- Triax Compatible - eliminates two phase flow of liquid nitrogen to use points
- One Year Warranty - covers materials and workmanship defects

Key Benefits

- Low Pressure N_2 - stored at atmospheric pressure to gravity feed LN_2
- Pure LN_2 Delivery - LN_2 at atmospheric pressure guarantees highly saturated LN_2 delivery
- Closed Loop System - re-circulate and re-use LN_2 through the Phase Separator and custom designed triax pipe
- On Demand LN_2 - LN_2 is stored in the Phase Separator for immediate, on demand consumption

Product Manual

This manual is intended for use by Chart phase separator customers. It is important to read and understand this information in this manual before installing or operating the system. This manual is provided by Chart to its customers as a courtesy and, except as expressly provided in this manual, Chart makes no warranties, express or implied, regarding the contents in this manual. Chart assumes no responsibility for any outcomes as a result of using this manual.

Additional copies of this manual are available by contacting chart at 1-800-371-3303.

The safety requirements for operating the phase separator and handling 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 Receiving and Installation section contains information about what should be included with the phase separator and how to install.

Operations and Troubleshooting information is available in the Operations section.

System specifications and schematic are located in the Specification section.

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:

ACR	Air Conditioning and Refrigeration
BAR	Pressure (Metric)
GN_2	Gaseous Nitrogen
ID	Inner Diameter
Kg	Kilogram
LN_2	Liquid Nitrogen
M	Meters
MBE	Molecular Beam Expitaxy
MTP	Male Pipe Thread
N_2	Nitrogen
PSI	Pounds per Square Inch

Safety

General

All operators should have full and complete understanding of the contents 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.

Warning! ***Your phase separator may be fed by a vacuum insulated pipe system designed to contain pressurized, ultra-cold cryogenic liquids. These systems should only be worked on by trained personnel to avoid serious injuries such as freezing, oxygen deficient atmospheres and extremely high pressures.***

Warning! ***Any configuration which allows a trapped volume of cryogenic liquid or cold gas must be protected by a pressure relief valve. As the cold liquid/ gas gains heat, the contents will expand and increase in pressure. A section not protected by an over-pressure relief valve will experience extremely high pressure and significant safety concerns.***

Warning! ***If you are at all unsure of how to safely work on this system, STOP and contact Chart immediately at 1-408-371-4932.***

Caution! ***Before removing parts or loosening fittings, empty the phase separator of liquid and release any vapor pressure in a safe manner.***

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.

Caution! ***As with any cryogenic system, is 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 shutdown and allowed to warm up.***

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.

Portions of the following information are extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. (CGA). For the full text of Safety Bulletin SB-2 and for more information about oxygen atmospheres, contact the CGA at www.cganet.com or write to the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202. Additional information on nitrogen and liquid cylinders is available in CGA Pamphlet P-9.

Oxygen Deficient Atmospheres

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.

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.

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.

Nitrogen

Warning! Nitrogen vapors in air may dilute the concentration of oxygen necessary to support or sustain life.

Nitrogen (inert gas) is a simple asphyxiate and will not 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 this gas 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. Contact with cold nitrogen gas or liquid can cause cryogenic (extreme low temperature) burns and freeze body tissue.

If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, the affected tissues should be promptly flooded or soaked with tepid water (105-115°F; 41-46°C). DO NOT USE HOT WATER. Cryogenic burns, which result in blistering or deeper tissue freezing, should be examined promptly by a physician.

Receiving and Installation

Receiving and Unpacking

The phase separator will arrive in a specially designed shipping crate.

Upon arrival of the phase separator, it is advised to immediately inspect for any signs of damage. If any damage occurred in shipping, claims must be filed with the shipping carrier immediately prior to unpacking the phase separator.

While unpacking the crate, all contents should be carefully inspected. Things to check for upon arrival include:

- Dents in the phase separator unit
- Male and female bayonets should be protected
- Proper number of bayonet clamps/flanges and o-rings (one set for every female bayonet)
- Any other components that were defined to ship loose

If there are any pieces listed on the Pack Slip and/or Materials List not in the shipping crate please contact Chart immediately at 1-800-371-3303.

Caution! ***When removing the phase separator unit from the crate, gently set it on the ground. Do not drop the phase separator unit! When transporting the unit through the facility, be sure to carry with care. Take care not to run into walls or drag the phase separator unit on the ground.***

Prior to installation, the phase separator should be stored in a location that will prevent dirt, water or other debris from getting inside the system. Similarly, it should be stored in a place that is generally out of the way of frequent traffic to reduce the risk of damage. Chart recommends storing the system in the crate when not in service.

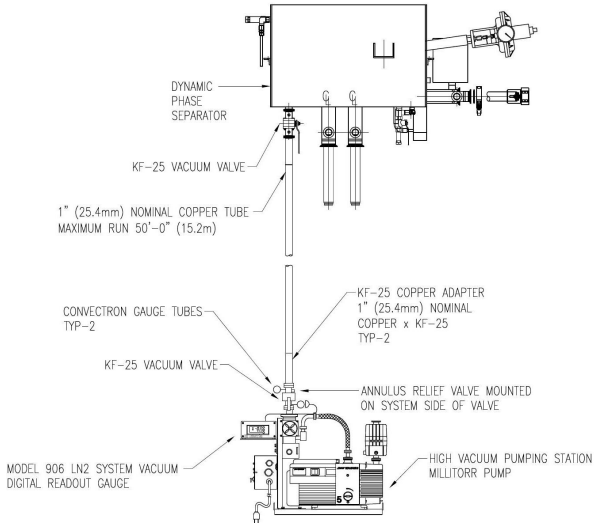
Installation

Mounting the Phase Separator

The phase separator is a 16” diameter stainless steel all welded vessel with mounting tabs welded on the side of the body. The phase separator must be securely installed in a level condition. Typical support materials are all-thread rod or metal channel. The weight of the phase separator empty is between 90 and 156 lbs (27.2 - 70.8 kg), dependent on the size and number of outlets. The weight full is from 140 to 288 lbs. (45.4 - 130.6 kg) dependent on the size and number of outlets. Allow sufficient distance in front of the phase separator for the installation of the feed line.

Note: *If the vent of the phase separator has a heater on it, allow at least three feet in front of the vent so that it will not exhaust cold gas onto a surface, otherwise condensation or ice may form.*

Installing the Vacuum Pump (for dynamic systems only)

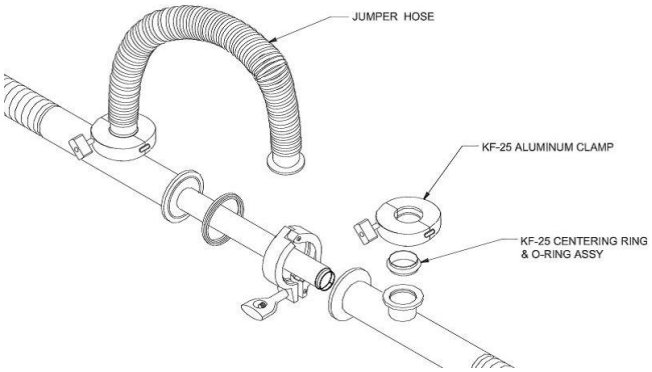


1. Two KF-25 vacuum valves are provided with the dynamic phase separator. Install one on the inlet bayonet to the phase separator and one on the lower vacuum port of the phase separator.
2. Install a 1” ID type ACR copper vacuum manifold to connect the vacuum port to a MilliTorr vacuum pump system (the pump should have a vacuum valve on it with thermocouple gauge tubes and a vacuum display).

Note: *Keep the distance of the copper manifold to less than 50 feet and minimize the numbers of bends in the manifold. The shorter the manifold, the better the pumping system will perform.*

Note: *The copper joints must be brazed not soldered. Purging the manifold with an inert gas during the brazing process is mandatory.*

3. Connect all vacuum ports together through the use of the supplied vacuum jumper hoses, o-ring assemblies, and clamps.



4. Test the integrity of the vacuum manifold piping by closing the vacuum valve on the phase separator and pumping on the manifold with the MilliTorr vacuum pump.

Note: *The MilliTorr vacuum pump system is a two-stage system that incorporates a mechanical vacuum pump and an oil diffusion vacuum pump.*

5. Turn on the mechanical pump and monitor the reading on the vacuum display. When the pressure level in the vacuum manifold is <100 MilliTorr, turn on the power to the diffusion pump. The vacuum level should read <3.0 MilliTorr after 20 minutes.

Note: *If the manifold does not achieve this vacuum level, it can be assumed that there is a leak in the manifold. Turn off the diffusion pump, wait 10 minutes and then turn off the mechanical pump before fixing any leaks.*

6. Once a vacuum reading is <3.0 MilliTorr, turn off the diffusion pump and open the vacuum valve on the phase separator.

7. The phase separator is ready for use when the level is <3.0 MilliTorr.

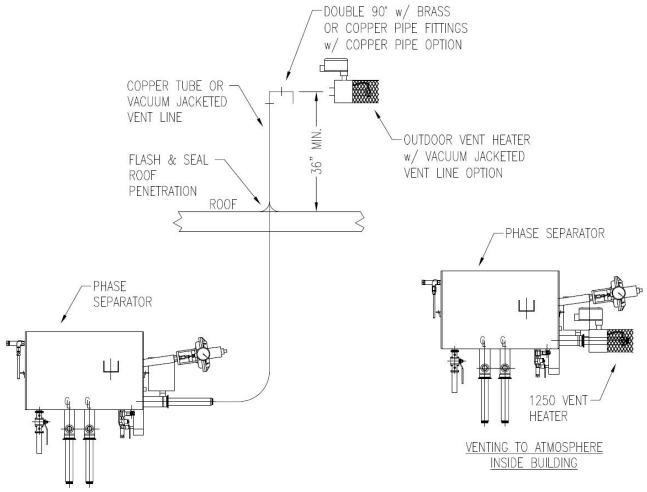
Phase Separator Vent

The vent of the phase separator removes gaseous nitrogen from the phase separator. The discharge from the vent is handled in two ways:

1. Flexible vacuum insulated vent line - this method transfers the gas from the phase separator to a suitable location for release. The vacuum insulated line prevents condensation on the exterior of the vent line. This method is recommended for applications where the phase separator is installed in either a clean room, or a confined space. The overall length of this type of vent line should be no more than 20 feet (6 meters) to avoid potential back pressure to the system. Install a “goose neck” out of copper or brass fittings to keep rain from falling down into the pipe at the termination of the vacuum insulated line.

2. Chart® supplied vent heater - this method utilizes a 24V heating element that is clamped to the male vent bayonet of the phase separator. The electrical cable is plugged into the bottom of the pneumatic control box located on the phase separator. The vent heater warms up the discharge point and prevents the formation of an ice ball.

Warning! Be sure the gaseous nitrogen discharge is not exhausted into a confined space.



Connecting the LN_2

Once the phase separator is mounted, make the following connections:

1. Connect the main feed line to the supply bayonet on the phase separator.

   a. This is accomplished by mating the main feed line male bayonet to the phase separator inlet female bayonet.

   b. Verify that the white silicone gasket is on the male bayonet before insertion into the supply bayonet on the phase separator. Use the supplied clamp to physically secure the bayonet connection.

   c. If a dynamic system, install the KF-25 vacuum valve and vacuum jumper hose at the inlet bayonet.

2. Install female bayonet caps to unused feed bayonets on the phase separator.

Note: *Bayonet connections are thin walled stainless steel tubing and must be treated with care so that the bayonets are not dented during assembly. Bayonet gaskets should be properly seated in the bayonet flange grooves.*

3. All branch piping should be supported with metal channel, piping hangers, trapeze racks, J-hangers, or clevis hangers. Use a continuous channel for supporting long flexible runs that are more horizontal.

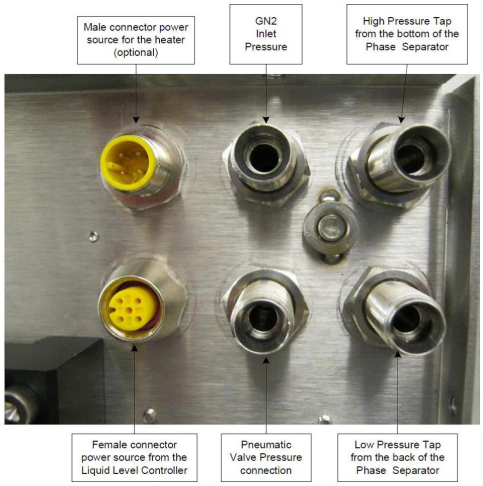
Note: *Piping drops from the phase separator require a downward pitch from the phase separator towards the use point. Chart recommends a minimum slope of 1/4" for every 12" horizontal run.*

Connecting the Pneumatic Controller

The pneumatic controller is essential to properly operate the phase separator. The High Pressure Tap, Low Pressure Tap, and Pneumatic Valve Pressure connections are connected at the factory. The vent heater, GN_2 inlet, and Liquid Level Display cable must be connected at the time of installation.

Gaseous nitrogen at 50 - 100 psi (3.45 - 6.89 bar) is required to operate the pneumatic controller mounted on the phase separator. The pneumatic inlet location (1/4" compression fitting) is on the bottom of the pneumatic control box mounted on the phase separator. This pneumatic inlet port can accommodate any 1/4" tubing.

Note: *Do not use air, even if compressed dry air (CDA), as it could void warranty!*



Installing the Liquid Level Display

The liquid level display is a wall-mounted, weather tight unit that can be installed remotely up to 500 feet away from the phase separator; a 10 meter cable is included to connect the phase separator to the liquid level display.

Locate the ideal location for the liquid level display. It is important that the liquid level display be mounted in a location where the display can be easily seen and where the users of the phase separator can hear the audible alarm. The liquid level display also has remote alarm contacts that can be used for remote monitoring of the alarm conditions.

Connect the 120VAC to the liquid level display through the use of the power cable (4 meter).

Enable/Disable - Manual over-ride feature that closes the phase separator inlet valve which stops the reservoir from filling.

Alarm Silence - This is a manual over-ride feature that silences the audible alarm. The alarm will remain silenced for a period of 30 minutes after each depression of the alarm silence button.

The connections to the bottom of the liquid level display are:

Input Power (J-1)

The pneumatic controller power cable is connected to the pneumatic controller at port J-1.

(J-4)

Connect the pneumatic controller cable (10 meter) to the Liquid Level Display at port J-4.

The side of the liquid level display has the following:

Alarm Buzzer

Power - Toggle between '0' (off) and '1' (on).

Liquid Level Display Readings

The phase separator liquid level display has the following indicators:

1. Phase Separator Level Indicator: A digital display showing the percentage level of liquid in the phase separator. 65% - 80% is normal.
2. Overfill Alarm Indicator: A red light is illuminated whenever the phase separator is filled to more than 90%. The audible alarm is activated whenever an overfill condition is detected.
3. Normal Condition Indicator: This green indicator is illuminated whenever the phase separator level is between 30% and 90%.
4. Underfill Condition Indicator: This yellow LED is illuminated when the level in the phase separator is below 30%. An audible alarm is activated whenever an underfill condition is detected.

Note: *It is normal to have fluctuations on the display during an initial fill.*

Liquid Level Display Contacts

The phase separator liquid level display has remote alarm contacts located inside the controller. These are provided to allow remote monitoring of alarm conditions of the phase separator. Sets of contacts are provided for both the Underfill and Overfill condition.

Operation

Overview and Basic Operation

Operation of Phase Separator

The purpose of a phase separator is to separate a two-phase flow of LN_2 to culminate in single phase, or pure liquid.

As LN_2 is under pressure and flowing through a pipe, the liquid is actually a mixture of gas and liquid hence the term two phase. In some applications it would be undesirable to use this mixture so a phase separator is installed on the pipeline. The phase separator has a vacuum jacketed inlet that connects to a pipeline. The LN_2 flows through a pneumatic valve into the internal reservoir of the phase separator. The liquid level is electronically controlled so that it will not rise to the top. The headspace at the top is continuously controlled so that it will not rise to the top. The headspace at the top is continuously vented to atmosphere through a 1" tube. The result is a reservoir of LN_2 that is at atmospheric pressure and is in single phase. Pipelines are attached to the bottom of the reservoir to allow LN_2 withdrawal.

Operation of Control

1. Pressure Taps: This liquid level is controlled by a 4-20 milliamp, pressure differential system. There are two pressure taps on the phase separator. The high-pressure tap is connected to the bottom of the reservoir and measures the weight of the liquid. The low-pressure tap is connected to the headspace of the reservoir and measures the pressure of the headspace. These two taps are connected to tubes that connect to a pressure transducer.

2. Pressure Transducer: The pressure transducer will measure the difference between the two taps and generate a 4-20 milliamp signal. When the phase separator is empty, a 4-milliamp signal will be generated and when the phase separator is full, a 20-milliamp signal will be generated. Proportional signals between 4 and 20 milliamps will be generated according to the liquid level.

3. Display Console: The milliamp signal is fed to a display console that will show the level of the liquid in percent. The display has a main power switch and an enable switch. This will allow one to see the level of the liquid while having the option to disable the pneumatic valve.

Set-Up and Operation

The Series 4000 phase separator liquid level display has the following indicators:

1. Phase Separator Level Indicator: A digital display showing the percentage level of liquid in the phase separator. 65% - 80% is normal.

2. Overfill Alarm Indicator: A red light is illuminated whenever the phase separator is filled to more than 90%. The audible alarm is activated whenever an overfill condition is detected.

3. Normal Condition Indicator: This green indicator is illuminated whenever the phase separator level is between 30% and 90%.

4. Underfill Condition Indicator: This yellow light is illuminated when the level in the phase separator is below 30%. An audible alarm is activated whenever an underfill condition is detected.

The Series 4000 phase separator has the following controls:

1. Main Power: Located on the bottom of the liquid level display.

2. Valve Enable toggle switch: Located on the bottom of the liquid level display. Label markings display '0' for disable and '1' for enable.

3. Alarm Silence Button: This is a manual over-ride feature that silences the audible alarm. The alarm will remain silenced for a period of 30 minutes after each depression of the alarm silence button.

4. Remote alarm contacts: Located inside the liquid level display, these are provided to allow remote monitoring of alarm conditions on the phase separator liquid level display. Sets of contacts are provided for both the underfill and overfill condition.

5. Verify that the LN_2 source is turned on. With the main power and enable switches on, the phase separator will fill with liquid and maintain a constant level automatically. It is normal to have fluctuations on the display during an initial fill.

Troubleshooting

Refer to the table below for troubleshooting procedures. The table is arranged in a Symptom/Possible Cause/Solution format. Note that possible causes for specific symptoms are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next. If you need further assistance please contact Chart's service team at 1-408-371-4932.

Symptom	Possible Cause	Solution
Phase separator inlet valve opens but does not fill.	Source valve not open or is empty.	Open source valve and verify available LN_2.
	Pipe and/or phase separator has lost vacuum.	Reinstate vacuum (if system is dynamic).
		Replace pipe and/or phase separator.
Phase separator inlet valve does not open.	Main power switch and/or enable switch is turned off.	Turn switches on.
	Interconnecting cable is not connected or is damaged.	Check cable connections at display and phase separator.
	Pneumatic pressure is low or shut off.	Check for minimum of 50 psi (3.45 bar) at inlet to pneumatic control box.
	Diaphragm of pneumatic valve is leaking.	Replace diaphragm.
	Pneumatic controller is damaged.	Replace controller.
	High-pressure tap connection is loose.	Tighten connections.
Phase separator overflows LN_2 out of vent.	High-pressure tap is clogged.	Drain phase separator and blow out tap into phase separator with GN_2.
	Pneumatic controller is damaged (valve is constantly open).	Replace controller.
Phase separator level is too high or low.	Preload bolt on the pneumatic valve head is maladjusted.	Turn bolt clockwise to lower level or counterclockwise to raise level.

Chart Service

As an additional service to our customers, Chart has a direct service number as well as extended service hours. For faster response, please use our service number at 408-371-4932 for any service related calls. For parts orders, please contact Chart at 408-371-3303 between the hours of 8:00 a.m. and 5:00 p.m. PST Monday through Friday.

Specifications

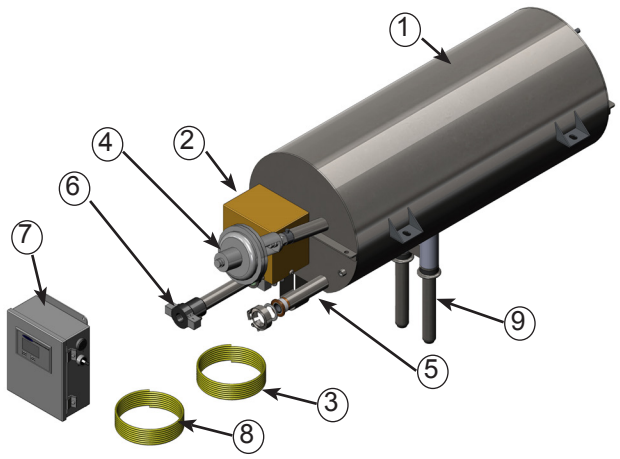
Product Specifications

Number of Outlets:	2 to 10 (even increments)
Capacity / Operational Volume:	Short Body (2 & 4 outlet std) 4.64 gallons (17.53 liters) Long Body (6, 8 & 10 outlet std, 2 & 4 outlet optional) 12.19 gallons (46.14 liters)
Weight (dependent on body and outlets):	Empty Condition 90-156 lbs (27.2-70.8 kg) Full Condition 140-288 lbs (45.4-130.6 kg)
Materials:	Stainless steel construction
Certifications:	NEMA 4X, CE

Utility Requirements

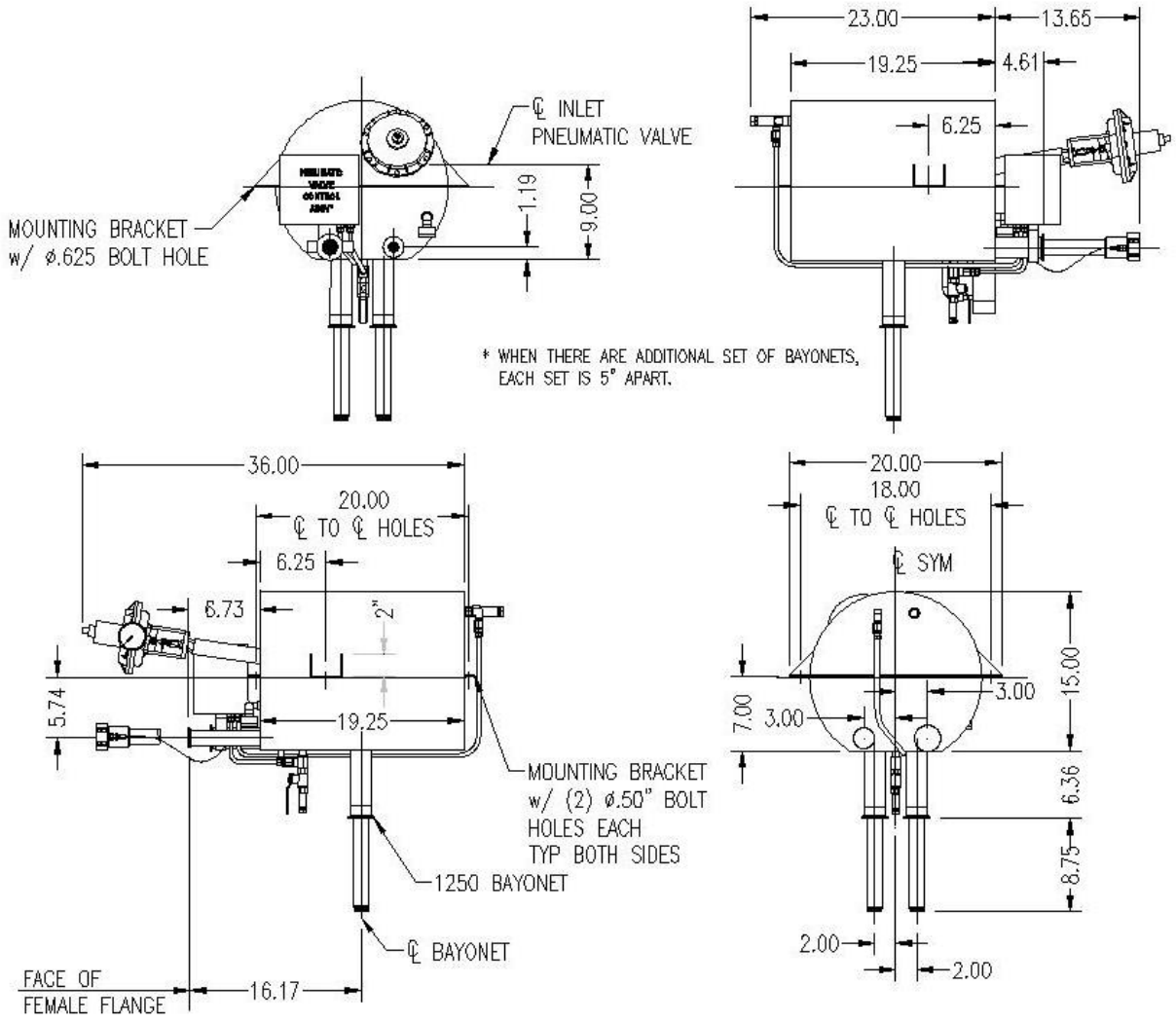
Electrical Supply:	100-240 VAC 50-60 Hz 110 W
Liquid Nitrogen:	Max. 125 psi (8.62 bar); 80 psi (5.52 bar) optimal
Gaseous Nitrogen:	50-100 psi (3.45-6.89 bar)

Standard Components

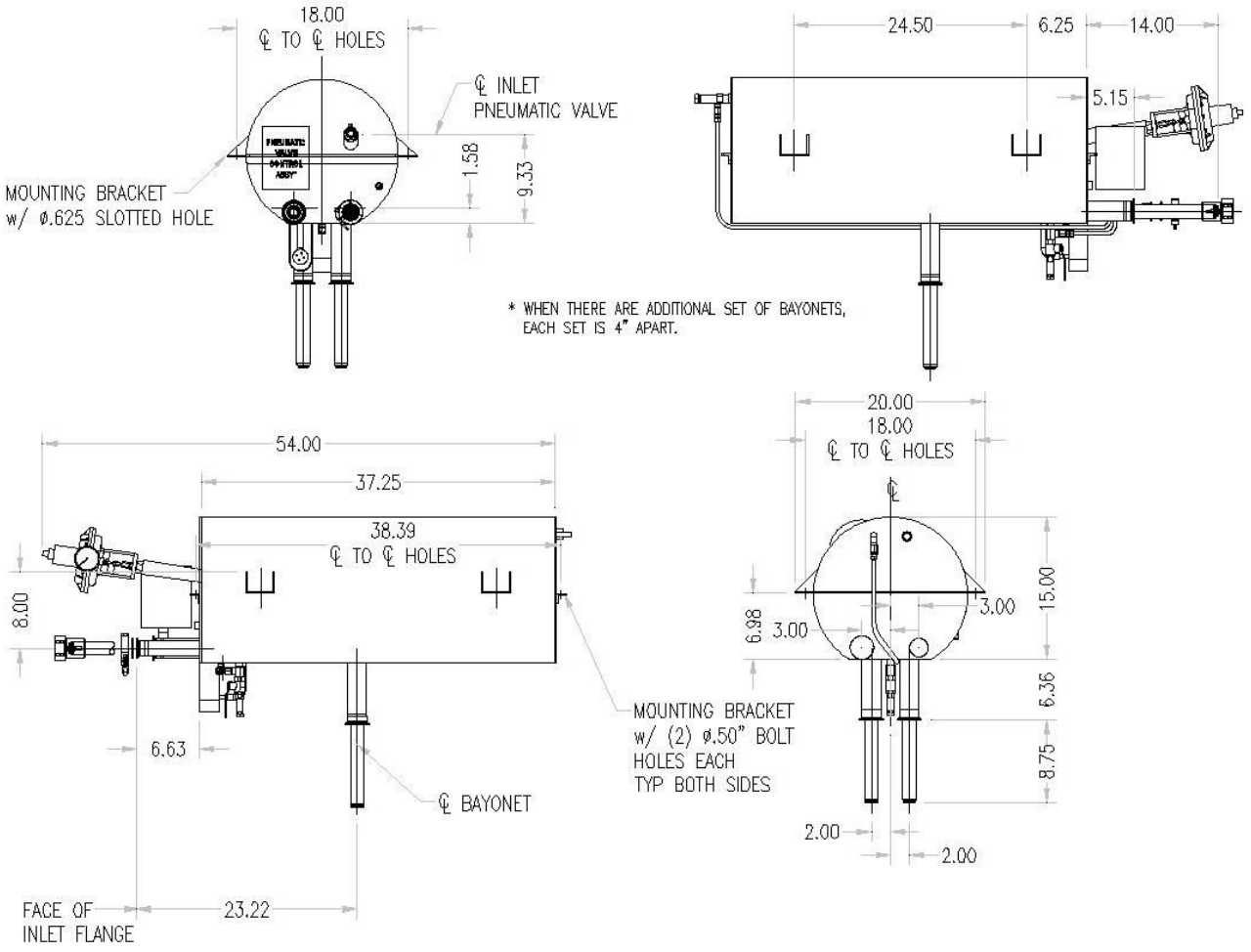


1. Phase Separator Body: The vacuum insulated reservoir that holds and stores liquid nitrogen at atmospheric pressure.
2. Pneumatic Controller: The pneumatic controller dictates the operation of the Phase Separator.
3. Control Cable: A shielded cable connecting the pneumatic controller to the liquid level display.
4. Pneumatic Valve: The proportional control valve allows liquid nitrogen to enter the Phase Separator body.
5. Supply Connection: A vacuum insulated close tolerance female bayonet connection connects the high pressure liquid nitrogen distribution pipe to the Phase Separator.
6. System Vent: A vacuum insulated close tolerance male bayonet connection exhausts gaseous nitrogen to the atmosphere.
7. Liquid Level Display: Display showing the liquid level of the Phase Separator body.
8. Power Supply Cable: Connect 120V electrical to the Liquid Level Display.
9. Feed Bayonet(s): Vacuum insulated close tolerance male bayonets to connect the pur saturated liquid to the point of use.
10. Vent Heater: 24V heater element that is clamped to the System Vent close tolerance male bayonet of the phase separator body.
11. 1250 Female (Feed) Bayonet Cap: Vacuum insulated bayonet caps must be installed on unused feed bayonet(s).
12. 625 T-Pattern Manual Globe Valve: Vacuum insulated manual globe valve should be installed upstream of the Phase Separator to isolate the liquid nitrogen distribution pipe from the Phase Separator for faster troubleshooting and maintenance.

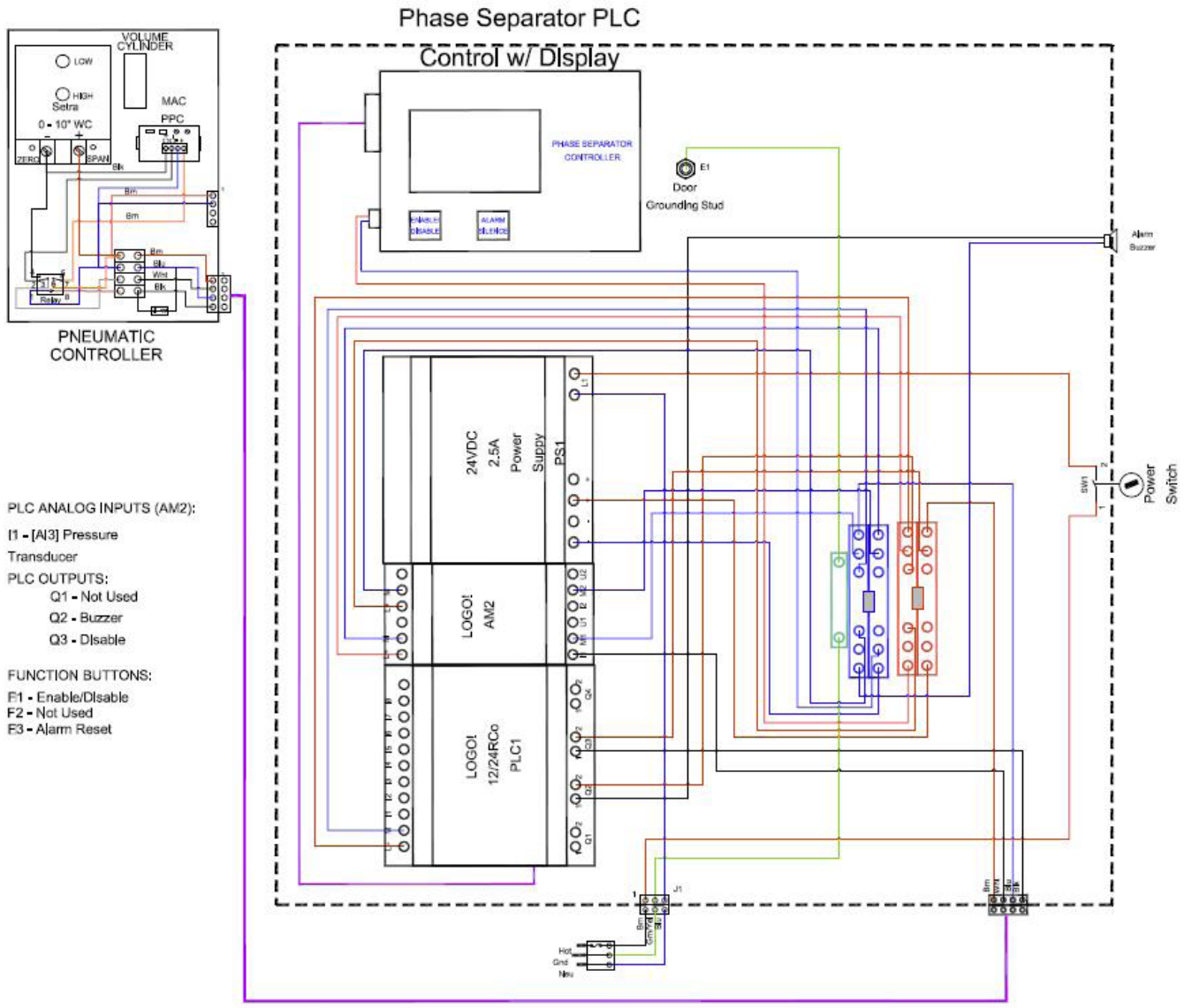
Short Body


23.00
13.65
19.25
4.61
6.25
℄ INLET
PNEUMATIC VALVE
MOUNTING BRACKET
w/ ø.625 BOLT HOLE
1.19
9.00
* WHEN THERE ARE ADDITIONAL SET OF BAYONETS,
EACH SET IS 5° APART.
36.00
20.00
℄ TO ℄ HOLES
6.25
6.73
2"
5.74
19.25
MOUNTING BRACKET
w/ (2) ø.50" BOLT
HOLES EACH
TYP BOTH SIDES
1250 BAYONET
℄ BAYONET
FACE OF
FEMALE FLANGE
16.17
20.00
18.00
℄ TO ℄ HOLES
℄ SYM
3.00
15.00
7.00
3.00
6.36
8.75
2.00
2.00

Long Body


18.00
℄ TO ℄ HOLES
℄ INLET
PNEUMATIC VALVE
MOUNTING BRACKET
w/ ø.625 SLOTTED HOLE
1.58
9.33
24.50
6.25
14.00
5.15
* WHEN THERE ARE ADDITIONAL SET OF BAYONETS,
EACH SET IS 4" APART.
54.00
37.25
38.39
℄ TO ℄ HOLES
8.00
6.63
℄ BAYONET
FACE OF
INLET FLANGE
23.22
20.00
18.00
℄ TO ℄ HOLES
℄
3.00
3.00
6.98
15.00
6.36
8.75
MOUNTING BRACKET
w/ (2) ø.50" BOLT
HOLES EACH
TYP BOTH SIDES
2.00
2.00

Wiring Diagram



Common Replacement Parts

Part Description	Part Number
PHASE SEPARATOR	
Liquid Level Display	4352
Phase Separator Replacement Display	4107
Complete Pneumatic Control Assembly	4168PV
1/2” Pneumatic Control Assembly	CR_6064
Controller Power Cord Assembly - 4 meter	410
10 meter Shielded Eurofast Control Cable (M x F)	478
Complete Badger Rebuild Kit	CR_6063
Badger Pneumatic Actuator - Bare	4101
Badger Diaphragm	6020.1
Badger Actuator Shaft O-ring	6020.2
Follower Teflon O-ring for Badger Head	6020.3
Badger Body Mount O-ring	6020.4
Rebuild Seals Kit (no diaphragm)	C6332
1/2” Pneumatic Valve Inner Stem Assembly	6064.1
1” Pneumatic Valve Inner Stem	6068.1
ACCESSORIES	
Low Voltage Vent Heater	4352
1250 Female Bayonet Cap	C6151
625 T-Pattern Manual Globe Valve	S60MTCD
1250 Y-Pattern Manual Globe Valve	S1OMYAB
MISC PARTS	
User Manual	4900
Y-Pattern Purge Kit	C6454

Warranty

All sales of phase separators from Chart Inc. (“Chart”) to the purchaser are subject to all applicable Chart standard terms and conditions in effect at the time of sale, unless otherwise agreed in writing by an authorized representative of Chart. In addition to the warranty stated in Chart’s standard terms and conditions of sale, Chart warrants to the original purchaser of Chart manufactured phase separator that for one (1) year after the date of shipment to the original purchaser said Chart manufactured phase separator will maintain all performance standards for said phase separator as published by Chart on the date of invoice.

Purchaser agrees that as a pre-condition to any Chart warranty obligation hereunder, purchaser shall fully inspect the phase separator immediately upon delivery to purchaser and shall give Chart written notice of any claim or purported defect within ten (10) days after receipt of the phase separator. As a further pre-condition to any Chart warranty obligation hereunder, purchaser shall return said purportedly defective phase separator, freight prepaid, to the plant of the manufacturer within thirty (30) days after receipt of the phase separator. Chart shall inspect the returned phase separator, and, if said phase separator is found defective, shall, at Chart’s option as purchaser’s sole and exclusive remedy, either (i) repair or replace such phase separator or any defective component or part thereof which proves to be defective, or (ii) refund the net purchase price paid by the original purchaser. Alterations or repairs by others or operation of such phase separator in a manner inconsistent with Chart accepted practices and all operating instructions, unless preauthorized in writing by Chart, shall void this warranty. This warranty does not extend to defects caused by the effects of normal wear and tear, erosion, corrosion, fire, or explosion.

Chart’s sole and exclusive liability under this warranty is to the original purchaser and shall not exceed the lesser of the cost of repair, cost of replacement, or refund of the net purchase price paid of the phase separator by the original purchaser. Chart is not liable for any other losses, damages, or costs of delays, including incidental or consequential damages. CHART SPECIFICALLY MAKES NO WARRANTIES OR GUARANTEES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, OTHER THAN OR WHICH EXTEND THOSE WARRANTIES EXPRESSED HEREIN. The original purchaser shall indemnify, defend and hold Chart harmless from any third party claims as a result of the use, sale, or lease of the phase separator.